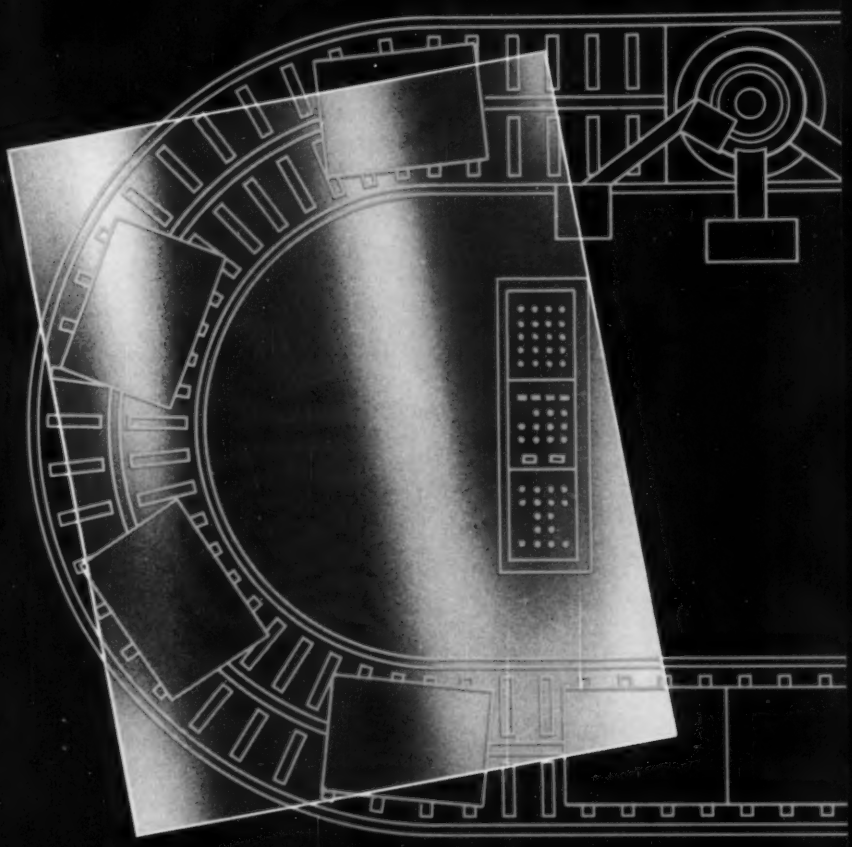
AUTOMATION

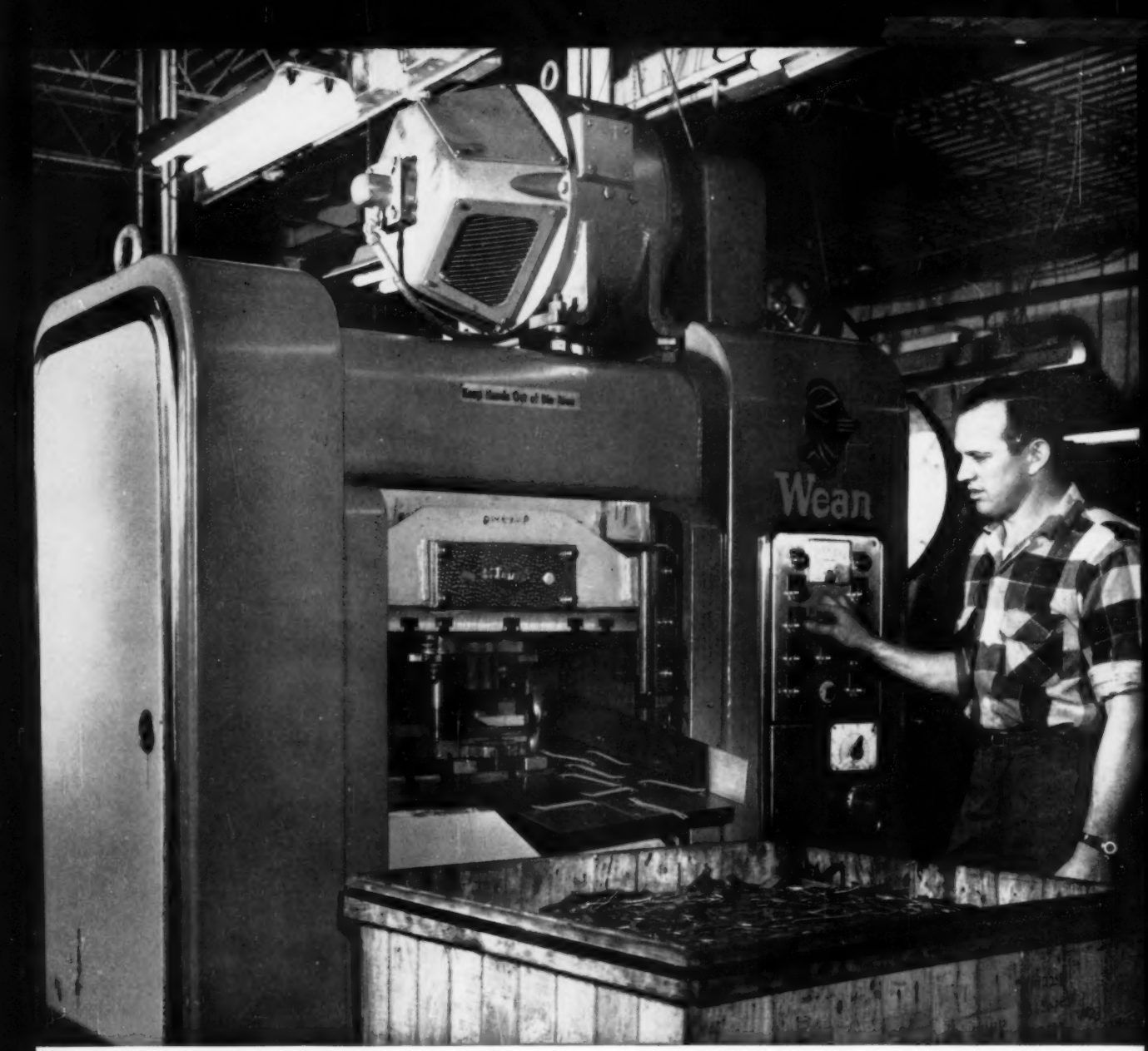
NOVEMBER 1957



GRINDING AND POLISHING

Plate Glass

The Magazine of Automatic Operations



Is the Wean "Flying Press"

the fastest press in the world?

WE THINK IT IS. While our top speeds have stayed around 600 strokes per minute on the "flying press," the size of piece is not restricted to washers and the like which are made on other high speed presses.

For example, where conventional presses rarely can process more than 100 feet of metal per minute, the "flying press" has performed at speeds in excess of 300 feet per minute.

One new model, for instance, blanks automotive assemblies 8 feet long at 45 per minute.

Yet, the "flying press" has other major advantages for you. Despite its revolutionary construction, it requires up to 20% less maintenance than other presses — it has no brake or clutch to wear. And, because of almost perfect dynamic balance, the press can be floor mounted.

We could write a book about the features of the Wean "flying press" — in fact we have. It's soon to be released . . . and it's yours for the asking. Write to the address below. We will mail your copy of the Wean "Flying Press" brochure as soon as it comes from the printers.

Wean Equipment Corporation

CLEVELAND 17, OHIO

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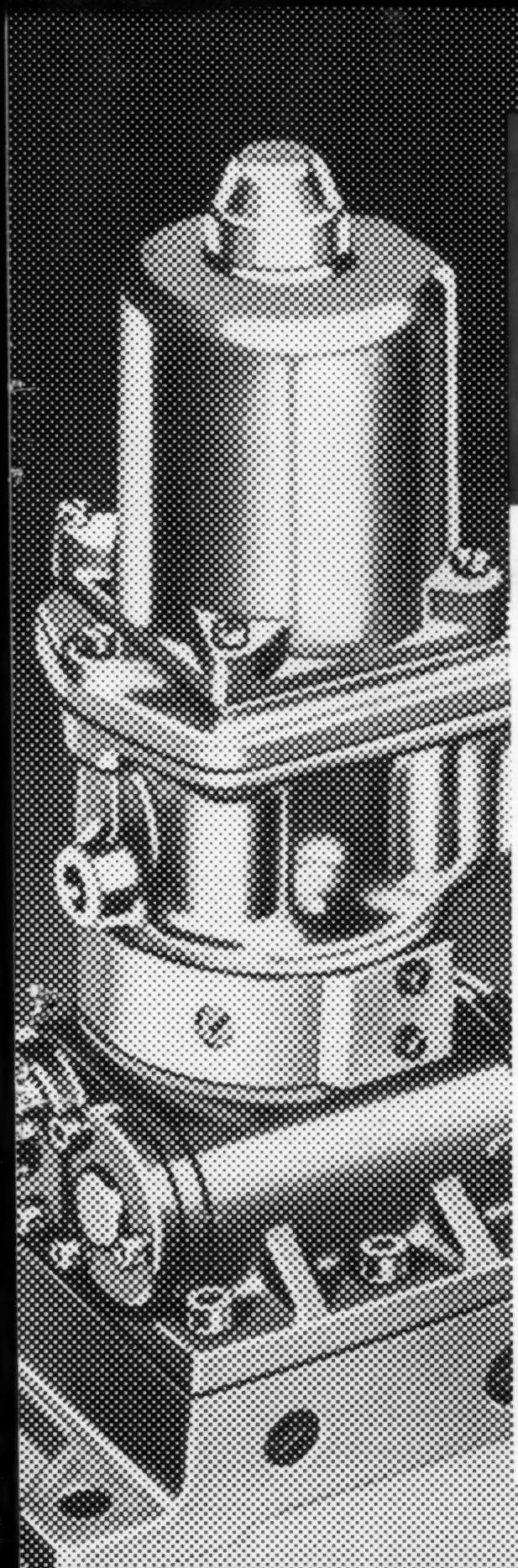
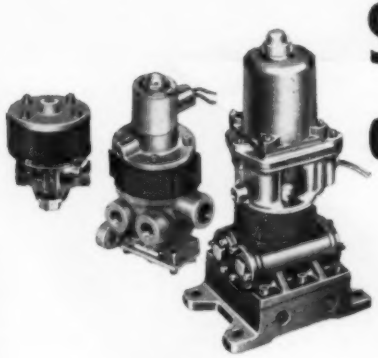


NEW-A totally different type momentary!

Ross ✶ Skyline **Double Stroke adapter**



Each time the single solenoid strokes the valve reverses and stays put

An air operated model is also available with which the valve reverses and stays "put" with every air impulse (pressurizing and exhausting) delivered to the single pipe opening in the head. The secret is a two part cycle in the adapter wafer which inserts between any skyline head and any skyline body. Hundreds of applications. Save space. Save cost. Save maintenance. *Do jobs never before possible.* Write for full details in bulletin 316.

Air Controls With Engineering and Ingenuity

Ross OPERATING VALVE COMPANY

131 EAST GOLDEN GATE AVENUE • DETROIT 3, MICH.

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from cold strip to finished tubing
IN SECONDS!
with a YODER
ELECTRIC-WELD TUBE MILL

One of the fastest . . . and one of the least expensive . . . methods of making steel tubing is with a Yoder Electric-Weld Tube Mill. The Yoder method eliminates the need for time-consuming heat treatments and costly conditioning furnaces for most tube needs. Scrap losses, too, are far lower than any other method . . . usually less than 2%.

The Yoder Type-M Mill shown above is operated by one man and a helper. Coiled strip on this mill is continuously cold-roll formed, welded and cut to required lengths in a matter of seconds . . . at speeds up to 340 f.p.m. The quality of the resulting tube is *constantly* better than the requirements of commercial standards. This is one of many reasons why manufacturers and users of tubing the world over are using more Yoder mills than all other makes combined.

If your business requires pipe and tubing, ferrous or non-ferrous, in sizes from ¼-inch to 26-inch diameter, Yoder can supply the engineering service and machines to produce it faster and better for less! For complete details, write for the Yoder Tube Mill Manual. It's yours for the asking.

THE YODER COMPANY
5526 Walworth Avenue • Cleveland 2, Ohio

ENGINEERING
YODER
MANUFACTURING

PIPE AND TUBE MILLS (ferrous or non-ferrous)
COLD ROLL FORMING MACHINES
ROTARY SLITTING LINES

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NOVEMBER 1957
Vol. 4—No. 11

AUTOMATION

A PENTON PUBLICATION

The Magazine of Automatic Operations

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automation outlook

ELI WHITNEY APPROACH

". . . complicated machines have a habit of frightening men. Inventors have been persecuted, progressive managements have been criticized, and the machines themselves have been blamed for all manner of evils. Laws have been proposed which would outlaw machines because they would throw men out of work. This is ridiculous, for statistics show that the higher the degree of mechanization, the higher the total labor force. . . Too often, the Frankenstein side of the picture is emphasized instead of the fundamental soundness of the Eli Whitney approach to modern production. . ."—*R. Bowling Barnes, president, Barnes Engineering Co.*

ACCOUNTING SHOULD BE REALISTIC

". . . as plants become more and more mechanized, the ratio of present burden to direct labor increases; arbitrary distribution of the greater part of expenses may lead to wrong conclusions in appraisal of economics or in estimations of cost. It is necessary to decrease the amounts which have to be distributed arbitrarily. To accomplish that it is essential to allocate expenses according to their nature and not according to their present names. . ."—*C. N. Neklutin, vice president, Universal Match Corp., director, Ferguson Machine Corp., see p. 38.*

WORLDWIDE APPEAL

". . . will automation spread to the less-developed countries? Clearly, the answer is 'yes'. Automation respects no national frontiers. It is not applicable only in the most industrialized countries. It is applicable everywhere . . . However fast or slow things may go, there is no doubt that the mere existence of automatic technology is now a significant fact in appraising the future course of world development and that the new techniques of production will find their way into the economies of the less-developed countries sooner or later—and perhaps much sooner than we think today . . ."—*David A. Morse, director-general, International Labour Office.*

AUTOMATIC CONTROL A NECESSITY

". . . I believe it is fair to say that virtually no modern refinery could be operated at economically efficient levels today without automatic control instruments. I say this, not from a consideration of the labor costs which would be involved if one were simply to try to encompass the operation of modern refining units with men rather than machines. Rather, the precision and speed of operation required by today's processes are such that human operators would be incapable of performing the tasks . . ."—*Chalmer G. Kirkbride, executive director, research, patent, and engineering departments, Sun Oil Co.*

ASSIST FROM THE MILITARY

". . . for a modern version of 'beating swords into ploughshares' there is no more striking example than the contributions which guided missile and other military weapons systems have and are making toward solving automatic data handling and control problems in private industry. The progressive nature of military research early recognized the imperative need for faster-than-human, more-reliable-than-human, capabilities. Through the development of automatic computer-controlled systems for anti-aircraft firing all the way to the latest preflight checkout systems for guided missiles, military research has brought automation techniques to their present high level, and has paved the way for their industrial utilization . . ."—*William Waddell, chief engineer, new products, Daystrom, Inc.*

AUTOMATION

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Published by

THE PENTON PUBLISHING COMPANY

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R. C. JAENKE .....Executive Vice President
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Subscriptions in United States, possessions, and Canada for home-addressed copies and those not qualified under above rules: One year $10. Single copies $1.00. Other countries: One year $20.

Published monthly and copyrighted 1957 by Penton Publishing Co., Penton Bldg., Cleveland 13, Ohio. Accepted as Controlled Circulation Publication at Cleveland, Ohio.

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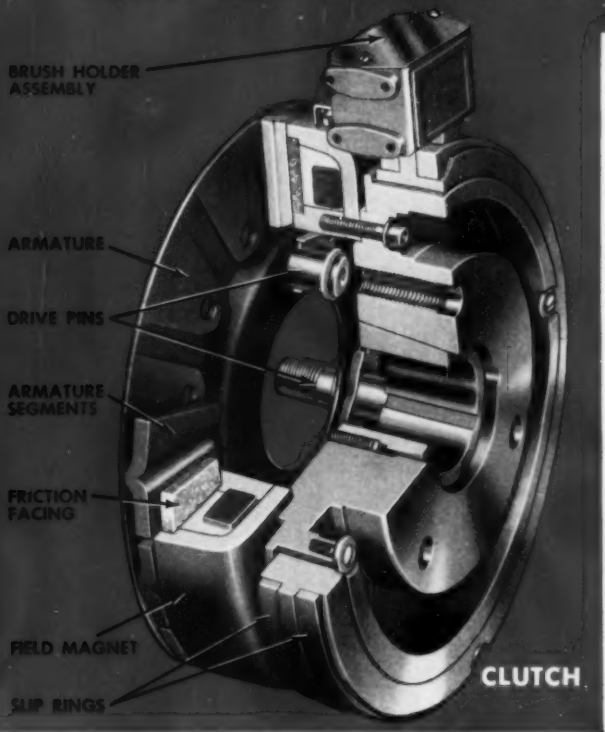
BPA NBP

The New EATON Dyna-torQ

MAGNETIC-FRICTION CLUTCHES, BRAKES, CLUTCH-BRAKES, CLUTCH-COUPLINGS

Are the Accurate, Trouble-Free Means of Controlling Power and Motion in Modern Stop-and-Go Machines



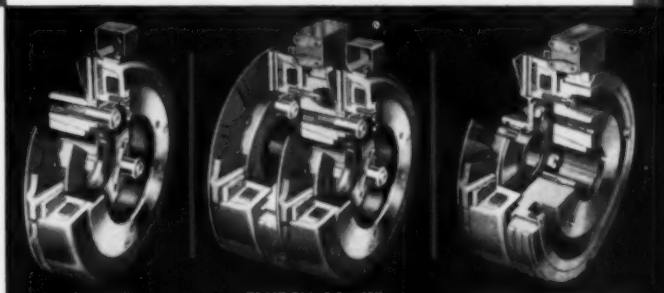
CLUTCH

The Eaton Dyna-torQ electro-magnetic friction units include a number of unique design advancements which provide longer life and superior performance with less maintenance. Check the following important advantages:

1. **Extremely Rapid Response in Clutching and Braking**—makes Dyna-torQ units ideally suited to a wide range of manual and automatic cycling applications.
2. **Smooth, Shockless Engagement**—permits rapid operation without backlash or chatter.
3. **Highly Effective Cooling**—maintains lower operating temperatures; permits fast, repetitive actuation.
4. **Self-Adjustment**—automatically maintains proper clearance between armature shoes and field magnet.
5. **Simple, Accurate Control**—manual or automatic; may be had to operate on 110, 220, or 440 volt, 60 cycle, alternating current.
6. **Low Maintenance Costs**—result from unique design features and superior quality of construction, assuring long operating life and minimum down-time.

Eaton Dyna-torQ Clutches and Brakes are electrically operated, disc-type friction units having two basic components: a field magnet and an armature. Torque is transmitted as the magnet pulls the armature into engagement. Because the pull of the magnet is direct without intricate linkage, and the movement of the armature is slight, Dyna-torQ units are capable of extremely rapid response in clutching or braking.

Ask us to tell you how these Dyna-torQ units will fit your equipment.



BRAKE | CLUTCH-BRAKE | CLUTCH-COUPLING

EATON®

WIDE RANGE OF SIZES AND CAPACITIES

Send for Illustrated Descriptive Literature

EATON

DYNAMATIC DIVISION

MANUFACTURING COMPANY

3307 FOURTEENTH AVENUE • KENOSHA, WISCONSIN

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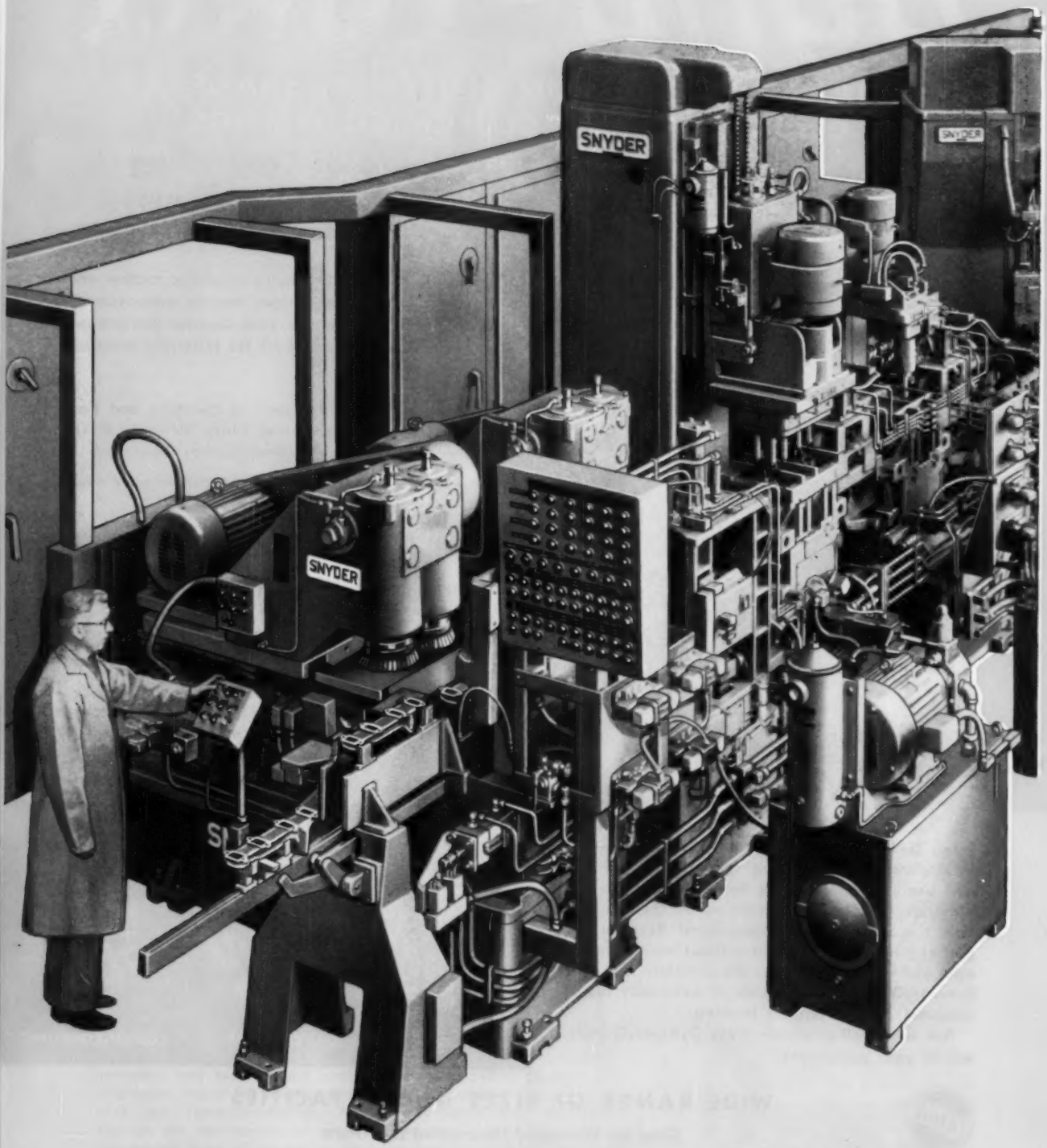
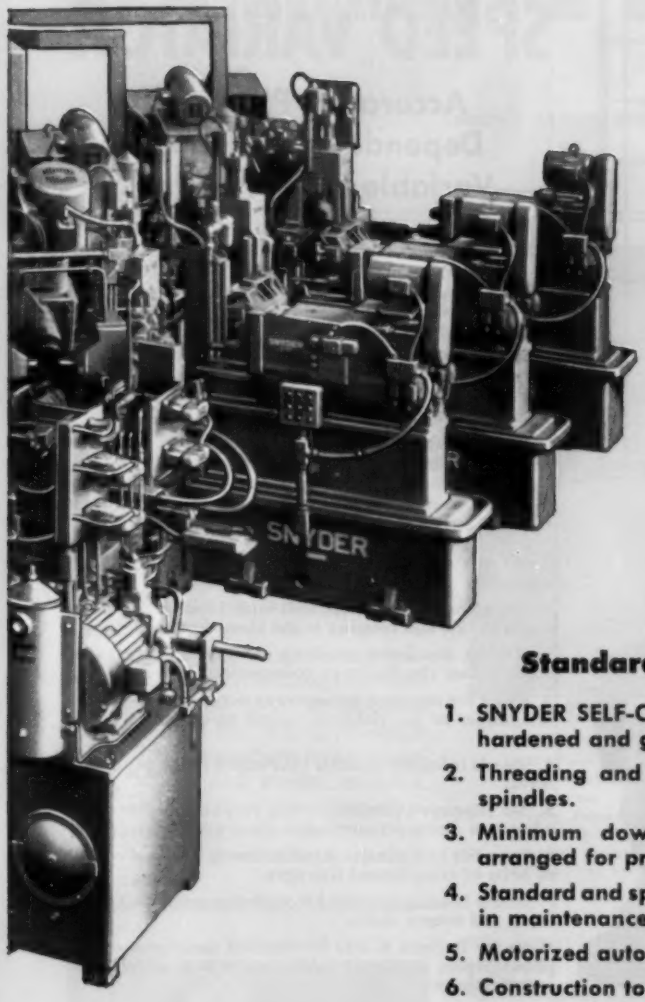
Two Different Exhaust Manifolds Processed by Snyder Special



Simultaneously in Random Sequence In-Line Transfer Machine



SPECIAL FEATURES

1. Production: 136 manifolds per hour.
2. 28 Stations: Operations include milling, drilling, chamfering, probing and tapping.
3. Manifolds "A" and "B", loaded at random, are identified by built-in sensing devices which activate or idle machining units at appropriate stations as required by the different parts. Parts "A" and "B" are identically processed at Stations 1, 4, 6, 7, 8, 9. At Stations 6, 7 and 9, sensing devices detect Part "B" and bring in automatic clamp support. Both parts are turned over at Station 12. Part "A" is processed at Stations 14, 16, 17, 18, 19. Part "B" is processed at Stations 22, 24, 25, 26, 27 and both parts are unloaded at Station 28 by automation equipment.
4. Individual base segments provide maximum flexibility for future part design changes.
5. Floor space: 63′ x 20′.

Standard Features of Snyder Machines

1. SNYDER SELF-CONTAINED UNITS and other units equipped with hardened and ground ways.
2. Threading and tap heads equipped with individual lead-screw spindles.
3. Minimum downtime for tool changes because spindles are arranged for pre-set cutting tools.
4. Standard and special parts interchangeable for speed and economy in maintenance.
5. Motorized automatic lubrication system for all moving parts.
6. Construction to J. I. C. Standards throughout.
7. Master Push Button Panel and Light Console at Station 1.
8. Each unit equipped with its own push button control station for ease of tool setup and manual operation of unit.
9. Electrical interlocks and full depth circuit throughout.
10. Panels equipped with SNYDER CIRCUIT SLEUTH.

SNYDER

TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

32 Years of Special Machine Tools with Automation

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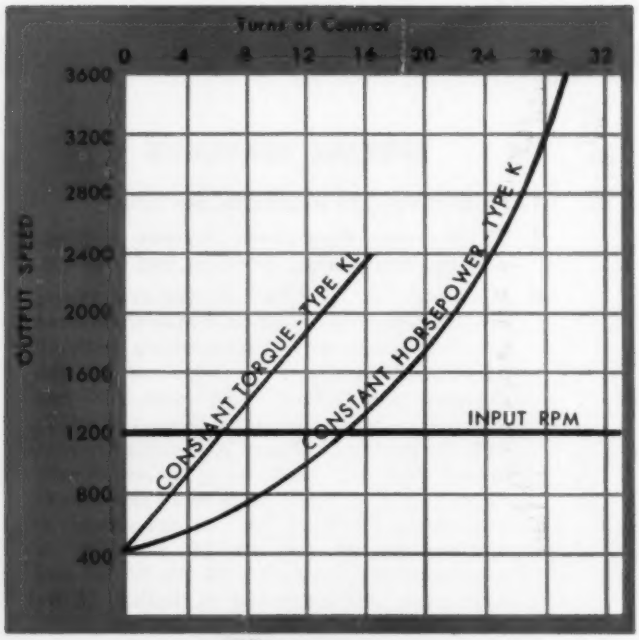
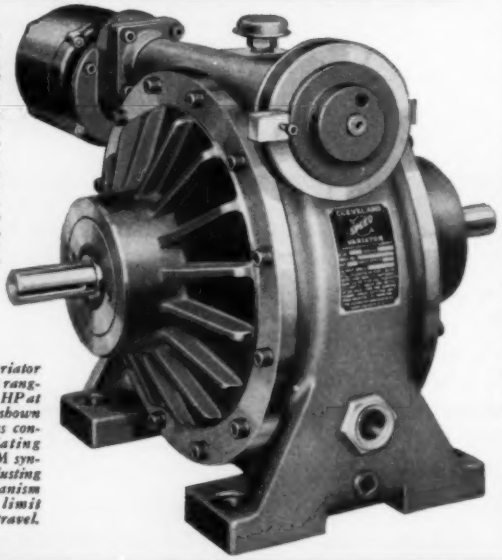


Typical speed regulation curves for the Types K and KL Variators. Type KL offers a linear speed regulating pattern, often an advantage in automatic control applications. Output speed regulation of the Type K Variator follows a geometric progression pattern. Starting at the minimum output speed, each turn of the speed regulating wheel produces a fixed percentage increase in output shaft speed.



The Cleveland Speed Variator is available in 18 models ranging from fractional to 16 HP at 1750 input RPM. Unit shown at right, used in process control, has speed regulating worm driven by 75 RPM synchronous motor, with adjusting shaft indicating mechanism modified to actuate limit switches to prevent overtravel.

CLEVELAND SPEED VARIATOR

Accurately Provides Dependable, Infinitely Variable Speed Control

ANNOUNCED late in 1954, the new Cleveland Speed Variator met instant, enthusiastic acceptance. Engineers and designers of industrial equipment already have put thousands of units into use on such varied equipment as cigarette making machines, textile machinery, metalworking machinery, pharmaceutical equipment, transfer tables, conveyors and experimental and testing equipment of many types.

Infinitely variable, the Cleveland Speed Variator gives stepless speed over a full 9:1 range—from ⅓ to 3 times input speed. Output speed can be adjusted by either a hand wheel on the Variator or by manual or automatic remote control.

The Cleveland Speed Variator offers these major advantages:

1. An extremely compact unit with input and output shafts in line and rotating in the same direction.

2. Almost any input speed up to 1800 RPM can be used—either clockwise or counterclockwise rotation.

3. Rated for constant horsepower output over a 9:1 or 6:1 range; or for constant output torque over a 6:1 range.

4. Speeds infinitely variable over entire range of adjustment.

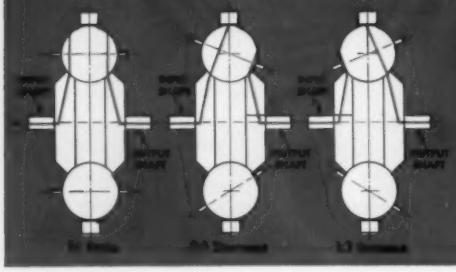
5. No slippage—positive torque response mechanism adjusts in direct proportion to the loads encountered.

6. Long life and minimum maintenance due to absence of belts or complicated linkages.

7. Ample bearing support for overhung pulleys on both input and output shafts.

Write for Bulletin K-200 for detailed description with photographs, sectional drawings, rating tables and specifications.

HOW THE CLEVELAND SPEED VARIATOR WORKS



Power is transmitted from input shaft to output shaft through alloy steel driving balls which are in pressure contact with discs attached to the two shafts.

Relative speeds of the shafts are adjusted by changing the positioning of axles on which the balls rotate (diagram, right, shows cutaway Variator with hand regulating wheel).

"It's the Drive That's on the Ball."

THE CLEVELAND WORM AND GEAR COMPANY

Speed Variator Division, 3265 East 80th Street, Cleveland 4, Ohio

Sales Representatives in all major industrial markets • In Canada: Peacock Brothers Limited.

Circle 660 on Page 17

AUTOMATION news

Today's events and developments in the field of automation

New Metalworking Concepts In Machine Tool Field

DURING the past few years, research engineers of Cincinnati Milling Machine Co. have contributed importantly to the reduction of machining costs in metalworking industries. The results of their progress were presented at a Technical Activities Seminar held during October by Cincinnati Milling and attended by executives and engineers from industries throughout the country.

An interesting program was presented ranging from numerical control of machine tools to problems of machining the new type alloys vital to the manufacture of supersonic planes and guided missiles. New ways to form metal by chipless machining were discussed as well as the use of ceramic cutting tools.

The Cincinnati Digi-Log numerical control of machine tools is a relatively simple system based upon the use of toroidal transformers. It is both an accurate analog system and an absolute system. Information is not lost when interruptions, such as power failure, occur. Cutter diameter compensation eliminates the need for preparing different programs for each size cutter. Practically any machine function now controlled by an operator can be governed by a numerical control system.

Introduced for the first time during the seminar was a new Cincinnati Spiropoint drill grinder. According to Hans Ernst, director of research, the new grinder generates a spiral point on twist drills. The new point is expected to render better cutting action, prove more productive and reduce drilling costs. Spiropoint grinders will be marketed by a subsidiary, Cincinnati Lathe & Tool Co.

During the seminar television was used to demonstrate to the audience certain research activities and equipment which could not be installed in the auditorium. The telecasts originated in a laboratory and were used by various speakers to illustrate some of the significant research and engineering developments discussed.

Research at Cincinnati Milling covers a wide range of activities. Channeled through the gateway of engineering, research effort culminates in the design, development, and manufacture of new products, new processes, and new machines. The Technical Activities Seminar was used to bring the newest of these developments to the

SECOND CONFERENCE on Manufacturing Automation, cosponsored by *Automation* and Purdue University, proved to be a highly successful sequel to the first conference held last year. This year's conference was notable for the time devoted to small round table discussions, enabling a freer exchange of information and opinions so necessary to progress. At the banquet held in conjunction with the conference, Representative Wright Patman, Texas, told of the national implications of automation (see Abstracts page 150). Pictured at the banquet are (left) E. S. Ault, Professor, school of Mechanical Engineering, Purdue; R. W. Bolz, editor, *Automation*; Representative Wright Patman; and Professor H. L. Solberg, Head of School of Mechanical Engineering, Purdue.

DURING a demonstration of the new Cincinnati spiral point drill, the operator measures the torque and thrust forces produced. Torque values were found to be equal to those for conventional drills, but thrust values were significantly lower.

attention of executives and engineers throughout industry.

NEW vice president and general manager of LeMaire Tool & Mfg. Co. is **Kenneth P. Martin,** formerly vice president of National Automatic Tool Co. LeMaire Tool manufacture automation equipment and special machinery and have designed and installed in-line process machines for the automotive, aircraft, construction equipment and farm implement industries.

New Associate Editor Joins *Automation* Staff

INTERESTS of the readers of AUTOMATION are best served by an editorial staff whose industrial experiences are directly related to basic problems facing industry in adopting more automatic operations. In this respect AUTOMATION is pleased to announce the appointment of **Julian E. Wilburn** as Associate Editor—an appointment that emphasizes the continuous growth of the magazine and its wide acceptance by industry.

Wilburn has had experience in both large and small manufacturing organizations where high quantity production was emphasized. Typically, in the small firm, his duties as mechanical-industrial engineer ranged the field including responsibility for special projects, cost analysis, plant layout, product research and improvement, methods analysis, and other specialized engineering work. It was here too that he had acquired a background for understanding basic supervisory problems, serving first as head of an industrial group and later as supervisor in a production department.

More recently before joining AUTOMATION, Wilburn served with the Western Electric Co. for approximately six years. Continuing his close association with automatic production facilities, he was concerned with product engineering problems involving plastic and rubber covered wire finishing equipment, and factory engineering installations of high pressure pumps, plating equipment and conveyorized ovens.

His original contributions to technology have been recognized by one patent grant, with several

Julian E. Wilburn

others pending, and his interest in writing evidenced by contributions to technical publications.

A graduate of Virginia Polytechnic Institute with a degree in mechanical engineering, Wilburn served in the Corps of Engineers during World War II. Time not spent with his family, which includes three children, is devoted to such hobbies as photography and model trains.

Salt Bath Safety Monitor

IMPULSE monitor introduced by Ajax Electric Co. automatically provides for shutting down an electric salt bath heat treating furnace in the event of control instrument or relay failure. Monitor responds to the duration of the energy input feeding the furnace rather than to conventional thermocouples or other heat measuring devices. In event of control failure, monitor shuts off power and signals an alarm.

Integrated Computer Systems Planned for Insurance Company

NETWORK installation of integrated electronic data processing systems, which will reduce months of insurance paper work to minutes of pushbutton data processing, will be made by the Radio Corp. of America for The Travelers Insurance Co. The network will embrace four separate RCA Bizmac electronic data processing systems, each with its own computer integrated through a single central point, similar to a telephone exchange.

The Travelers installation will represent the nation's largest in-

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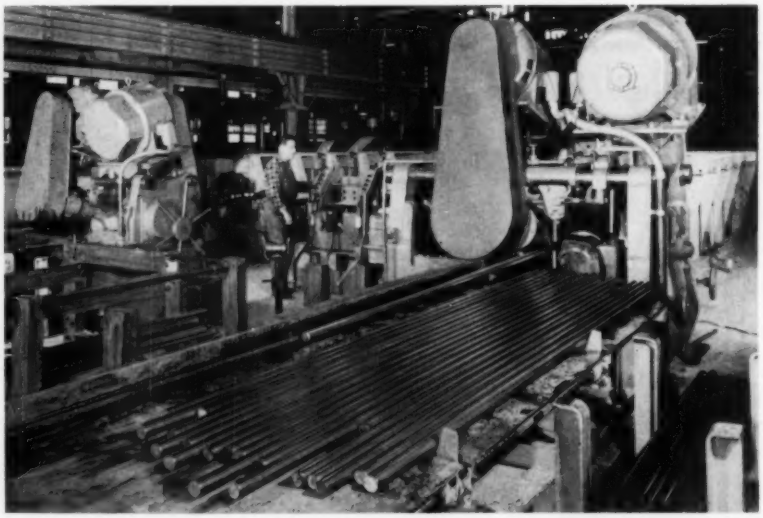
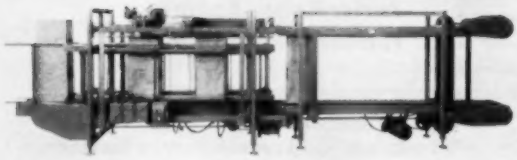


HIGH speed Blow-Knox precision straighteners are handling the output from a new cold drawing installation at American Steel & Wire Div. of U. S. Steel. The new line operates at drawing speeds up to 450 fpm for bar sizes ranging from 1 to 4½ inches. The straighteners perform the dual function of straightening and polishing simultaneously. The line is automated to the extent that the bars are fed from the shear to the stocking tables, into the feed troughs and through the straighteners, and into discharge storage cradles in one operating cycle. The finished bar product is used in precision equipment for machine tools, textile mills, printing machinery, and automotive components.

Circle 659 Page 17→



PACKOMATIC FULLY-AUTOMATIC BALE SEALER

For virtually every product—bulk or pre-packaged—the multi-ply kraft paper bale offers a safe and economical shipping medium. The Packomatic Fully-Automatic Bale Sealer—with speeds up to 1000 per hour—seals securely and adds time-and-labor savings. Designed originally to handle and seal bales up to 100 lbs. weight, this machine can be customized to practically any bale size and production requirement. Let one of our sales engineers explain how your product can be shipped in bales—faster, for less.

J. L. FERGUSON CO. Joliet 2, Ill.

New York, Chicago, Cleveland, Boston, Tampa, Baltimore, Portland, Denver, Los Angeles, San Francisco, Seattle, New Orleans, Louisville, Kansas City and All Principal Canadian Cities.

PACKOMATIC machines include the Bale Sealer — Case Sealers — Opener-Loaders — Case Imprinters — Telescoping Volumetric Filler — Packer-Gluers. Units available, semi-automatic or fully-automatic depending on your needs.

Packomatic

T.M. Reg. U. S. Pat. Off.

equipment feeds, forms, positions, loads, seals, and imprints shipping containers automatically

The fully-automatic Bale Sealer is one of many Packomatic machines designed to handle your shipper-packing requirements—more economically and at a speed to match any production line. However you ship—in multi-ply paper bags or in corrugated shipping containers—whether you're packing cans, cartons or bulk material, there's a Packomatic ready to do your kind of job. Today, Packomatics are opening corrugated flats, positioning and loading containers, sealing and imprinting—fully automatically. Other models can do any of these operations singly as a complement to your present line. Investigate the Packomatic method of cutting costs and boosting production in your plant.

Six 5-qt. cans or gallon cans in 20⅞" x 13⅜" x 9 1⅜/16" case and 20¼" x 13¾" x 8¼" case

Twelve 46 oz. cans in 21" x 13" x 7⅞" case

Twenty-four cartons in 12½" x 10⅝" x 8½" case

Eighteen 7 & 8 oz. cartons in 20" x 14⅞" x 8⅛" case

Sixty cigarette cartons King Size: 17⅞" x 11½" x 22" Regular: 14 1⅜/16" x 11½" x 22"

TYPICAL CASE LOADING PATTERNS FOR CANS AND CARTONS

Twenty-four 12 oz cans in 16⅜" x 10 15/16" x 5 5/16" case

Six No. 10 cans in 22 1/16" x 17⅜" x 7⅛" case

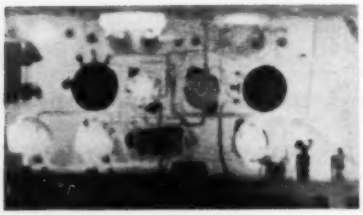
Thirty 1 lb. cartons in 16⅛" x 10 5/16" x 7¼" case

Twenty-four cartons in 19½" x 10⅞" x 7" case

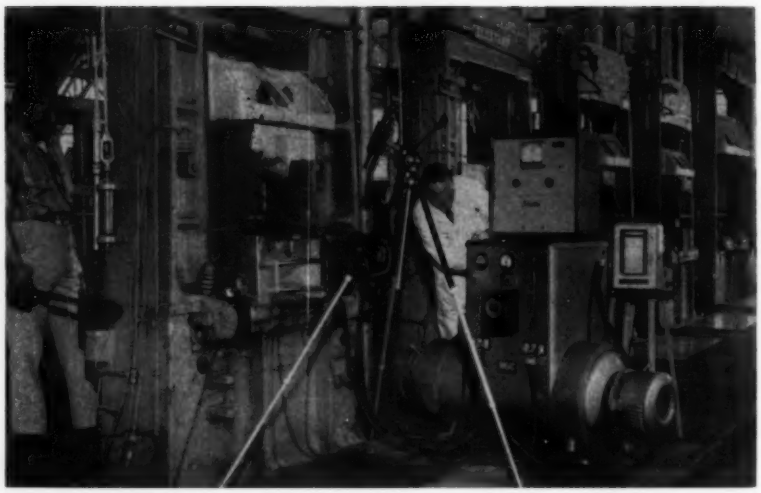
Forty-eight cartons in 22¾" x 23½" x 15⅞" case

ing system under one roof. When it is completed, it will include more than 270 units of twelve different basic types of Bizmac equipment. Installation of the first part of the system will begin early next year. It is expected that the overall system will be completed by 1963. The system will enable The Travelers to extend the speed, efficiency and economy of electronic data processing individually to multiple-line operation. Simultaneously the overall network system will compile company-wide statistics, facts, and projects essential for top management planning, direction and decision-making.

The RCA Bizmac system includes four basic types of units: Input devices, for preparing and feeding information and instructions into the data processing system; magnetic storage devices, for filing information within a system so that it is readily available and accessible on demand; data processing devices, standard or special purpose electronic computers for sorting and computing information as dictated by instructions; and output devices, for providing finished copies of the information required. In addition, other special Bizmac units will be included in The Travelers installation, to extend its flexibility and capacity. One of these is an interrogation unit which is used to extract urgently needed information from any storage file almost instantly without disrupting the work of computers or other units.



INFRARED camera for thermal photographs has been developed by Barnes Engineering Co. The Barnes camera detects infrared radiation and converts it into black and white photographs. Each point on the photographic image indicates the heat being emitted by that point and can be converted into temperature readings. Typical infrared pictures of an electronic chassis are illustrated. White areas represent heated components such as tubes, transformers, and resistors. Dark areas are cool components such as chassis and wiring.



TITANIUM metal is now being resistance heated in the bed of a drop hammer at Republic Aviation Corp. prior to being formed into complex shapes for aircraft applications. Forming temperature for titanium is critical and deviations will adversely affect the quality of formed metal. Infrared pyrometer on tripod, developed by Servo Corp. of America, detects softening temperature from a distance and records data on chart at right of press for quality control department. Resistance heating method is fast and eliminates need for auxiliary furnaces which consume floor space.

NEW sales manager of Buhr Machine Tool Co. is **Chester S. Johns**, formerly with Cross Co., Detroit. Buhr Machine Tool manufactures multiple-spindle high production machinery. **Vernon H. Samson,** formerly an accounting executive with Whirlpool Corp., has also joined Buhr's staff as controller.

ENTRY of Narda Microwave Corp., Mineola, N. Y., into the ultrasonic industry has been announced by **John C. McGregor,** president. Narda Ultrasonics Corp. has been formed as a subsidiary of the parent company to provide ultrasonic cleaning machines and metalworking equipment, and ultrasonic components for original equipment manufacturers. **Paul Martin Platzman** has been appointed vice president and sales manager for the new subsidiary.

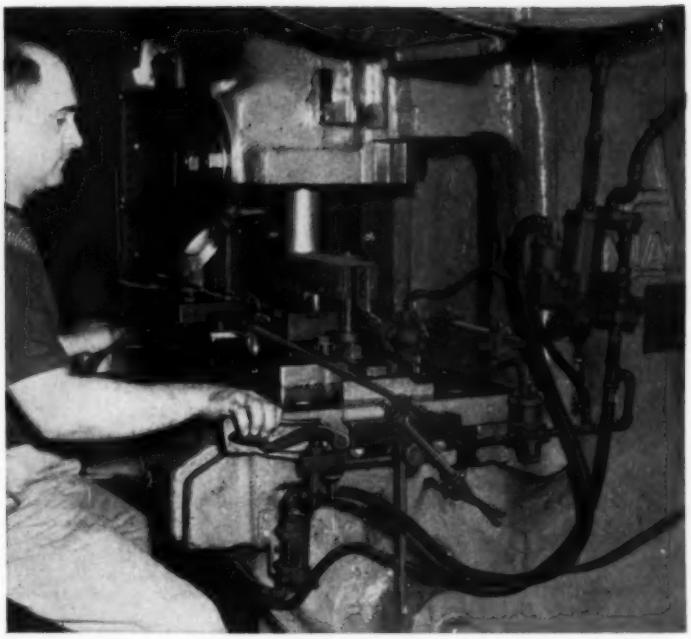
Parker-Kalon Acquires Fastener Feeding Line

EXCLUSIVE American manufacturing and sales rights to the patented Pneuma-Serve fastener feeding equipment has been granted by Geo. A. Tinnerman Corp. to Parker-Kalon Div. of General American Transportation Corp.

Parker-Kalon will market automated Pneuma-Serve equipment nationally together with its line of self-tapping sheet metal screws and other industrial fasteners. The Pneuma-Serve device is a portable fastener feeding machine by which any type of standard commercial screw, including those with preassembled washers, can be fed from a hopper through a plastic delivery tube to any standard electric or air driven power screw driver. It incorporates a selective release mechanism which controls the entry of fasteners into the plastic delivery tube so that oversize or mixed screws can be ejected before they enter the feeder mechanism.

Pneuma-Serve equipment eliminates hand placing of screws on

For automation and safety... Schrader Packaged Air Sets upgrade machine tools

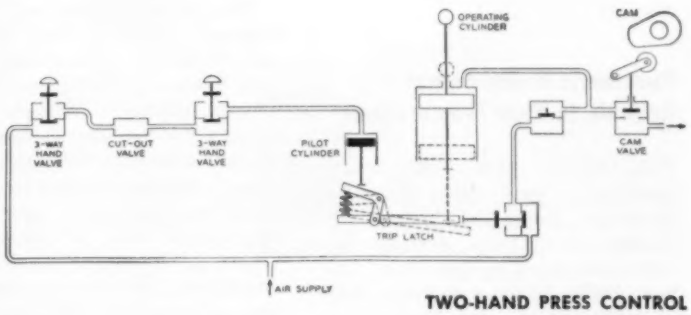


Punch press will not operate unless both hand valves are pressed at once. The press cycle cannot be repeated until the hand valves are released and the pilot cylinder is vented to atmosphere by the cam valve. A cutout valve prevents continuous press operation with one hand valve tied down. Air ejection is accomplished by cam action that actuates air column. Safety first with a Schrader Packaged Air Set.

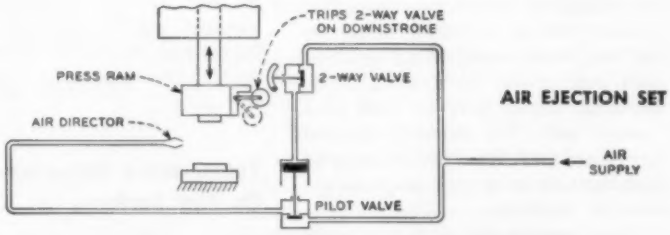
Schrader Packaged Air Sets eliminate hazards to press control and ejection systems operators like the man at right. They force him to keep his fingers free because the hands that feed the press or tool must also operate it. And both hands *must be used at once*—can't stray into danger. Fast, clean air ejection—moves the part off—automatically!

At the same time, performing both stamping and ejecting, finger and toe-tip action is light as air—keeps this operator fresh and efficient—steps up production! You can have the same!

Use these versatile pneumatic machine controls and air ejection sets not only on power presses, but shears, brakes, friction clutches, and any machine using a mechanical clutch. They are "off-the-shelf" items—ready to use! Write Schrader for details. Our distributors are located close by. Your most special requirements will in all likelihood be no problem at all with convenient, low-maintenance Schrader packaged control sets.



TWO-HAND PRESS CONTROL



AIR EJECTION SET

Schrader®
a division of SCOVILL

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
472 Vanderbilt Avenue, Brooklyn 38, N. Y.
QUALITY AIR CONTROL PRODUCTS

A. SCHRADER'S SON · Division of Scovill Mfg. Co., Inc.
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Please send latest informative booklets which show Schrader's complete line of products.

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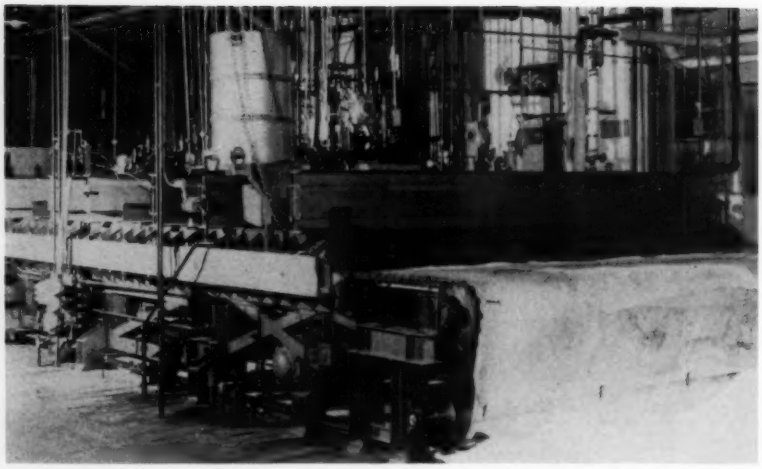
Circle 658 on Page 17



LEATHER processing machine recently developed by Seco Venture, Peabody, Mass. Machine makes possible continuous tanning, fat-liquoring, and drying of upper leather in a closed solvent handling system. After trimming, slitting, and soaking in a water solution containing tanning chemicals, leather hides are fed into the Secotan machine. While being transported automatically through the machine, hides are dehydrated and tanned with solvent, fat liquored, and heated to drive off the solvent for reclamation. Commercial installations of the Secotan machine will be made by Proctor & Schwartz Inc.

assembly functions and is credited with saving up to 1350 hours of driving time per million screws when compared with hand methods.

Pneumatic Power Source Reliable In High Temperatures

PNEUMATIC power unit which operates in temperatures above the tolerance range of known hydraulic or electrical systems has been announced by Lear Inc. The new device offers a reliable, fast-response power source for such applications as thrust reversers, accessory drives, actuation of air inlet and nozzle-positioning systems and reactor-rod positioning. The versatile device may be used as a power unit for remotely-located screwjacks of linear actuators and is adaptable to a wide range of actuation methods.

An exceptionally high torque-to-inertia ratio allows the units to follow electronic modulation and to deliver virtually instantaneous starts and stops. One model accelerates from zero to 100 rpm in one twenty-five-thousandth of a second, operating under 30 psig of applied air pressure against an opposing force of 20 pound-inches. Units are instantaneously reversible and are equally efficient in either direction. Torque of the air motor is proportional to gage pressure of the air and is virtually unresponsive to temperature changes.

The devices are controlled by an external signal which drives a fully-balanced, center-fed, four-way pneumatic barrel valve. Rotation of the valve pressurizes the motor for either clockwise or counterclockwise rotation. Overcoast is sharply limited by the dynamic braking which results when the control valve is moved to the center Off position. Under these conditions, the air motors function as a vacuum pump on the inlet side and a compressor on the exhaust side. Units are available in ratings from 0.66 to 30 hp, operating on pressures from 10 to 300 psig.

Temperature Detection On Flat Surfaces

THERMAL ribbon manufactured by Minco Products Inc. provides a means of electrically detecting the temperature of the surface to which it is attached. Extremely flexible and with negligible thermal lag, Minco's thermal ribbons are ideally suited for use in applications where it is necessary to accurately monitor or control temperatures of surface areas. Thermal

New!

New 201LS1 "Plug-in Limit" with roller arm actuator

YOU CAN CHANGE THIS PRECISION LIMIT SWITCH IN SECONDS

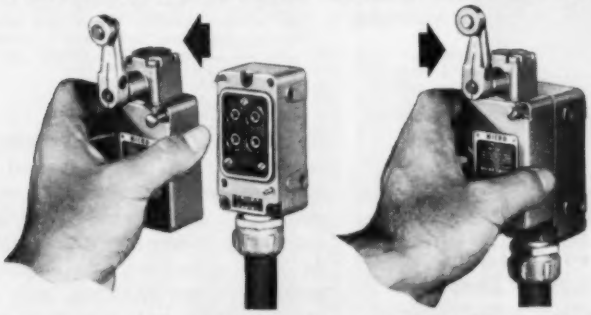
This new MICRO SWITCH "Plug-in Limit" switch is designed for highly automatic production-line service. Wiring connections are made to a sealed terminal block which is permanently mounted on the machine. Once wired and mounted, the terminal block need never be removed. All moving parts—both mechanical and electrical—are contained in a separate switch enclosure which is plugged directly into the terminal block. Permanently attached dowel pins assure exact positioning. Since the actuating arm on the switch can be pre-set, the switch may be plugged in with no further adjustment. No re-wiring or re-mounting necessary. This means that you can change switches with no machine down time or other interruption of production.

Circle 661 on Page 17

MICRO SWITCH . . . FIRST IN PRECISION SWITCHING

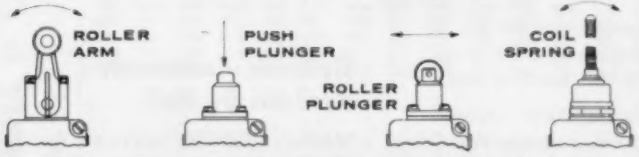
A sealed switch you can replace IN SECONDS! MICRO SWITCH "Plug-in Limit" (2-circuit switch)—cuts costly down time . . . no wiring . . . no mounting

Just PULL OUT and PLUG IN



You can change the new MICRO SWITCH "Plug-in Limit" switch in a matter of seconds—no re-wiring or re-mounting. Just loosen two captive screws, pull out the switch enclosure, plug in the replacement, and tighten the screws.

Actuators available to meet all requirements



Adjustments provide unusual versatility

1· Terminal block enclosure may be mounted on three surfaces and from four directions.

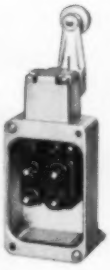
2· Roller-arm actuated switch may be adjusted to operate clockwise, counter-clockwise or both.

3· Operating head of the roller-arm actuated switch can be easily faced in any of four directions.

4· The roller arm is adjustable through 360° and can be positively locked at any position.

FOR COMPLETE DETAILS, SEND FOR BULLETIN NO. 20

PRECISION SNAP-ACTING BASIC SWITCH



The switch enclosure, contains all moving mechanical and electrical parts, including the plug-in unit. The spring plugs are integrally molded to the precision snap-acting switch body. Sturdy molded barriers protect plugs from damage.

RUGGED TERMINAL BLOCK

Wiring connections are made to a sealed terminal block enclosure which is permanently mounted on the machine. Under normal conditions the terminal block and its enclosure need never be removed from the machine.

ELECTRICAL CHARACTERISTICS

Contact Arrangement	10 Amp.	½ H.P.	1 H.P.	0.8 Amp.	0.4 Amp.	0.1 Amp.	Pilot Duty
2-circuit double-throw	120, 240 or 480 vac	120 vac	240 vac	115 vdc	230 vdc	550 vdc	660 vac max.

Meets NEMA Standards

The MICRO SWITCH completely sealed "Plug-in Limit" meets the requirements of NEMA Industrial Control Standards for non-ventilated enclosures of type IV-1C1-1.12 watertight and type V1-1C1-1.15 submersible.

For complete information on the MICRO SWITCH "Plug-in Limit" send for Bulletin 20 or call MICRO SWITCH Engineering Service at the branch office near you.

MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

In Canada, Leaside, Toronto 17, Ontario • FREEPORT, ILLINOIS

Circle 661 on Page 17

another automated device from Feedall

NEW AUTOMATIC

Feedall

Combines barrel-dump self-loader and variable-speed elevating feeder

SPECIFICATIONS
Model 9000 Barrel Dumper

CAPACITY: handles up to 1100 lbs. of material.

CONTROLS: push-button operated, with magnetic brake motor. No air or hydraulic system required.

SPEED: can be cycled to conveyor line, or actuated by feeder cycle.

SIZE: occupies less than 8 square feet.

This versatile unit does a lot of cost-saving — and speeds production too. It combines two standard Feedall machines into a single parts-feeding unit, eliminates costly hand-feed, adds steady production flow, and cuts handling time.

Outstanding feature is the new push-button controlled Barrel Dumper, Feedall Model 9000. It handles up to 1100 lbs. of material, loads the Feedall 2500 Elevating Conveyor, and speeds both parts handling and conveyor operation. Designed for heavy-duty service, the Barrel Dumper has welded-steel plate construction and simple operating controls. The complete unit occupies less than 8 sq. ft. of floor space.

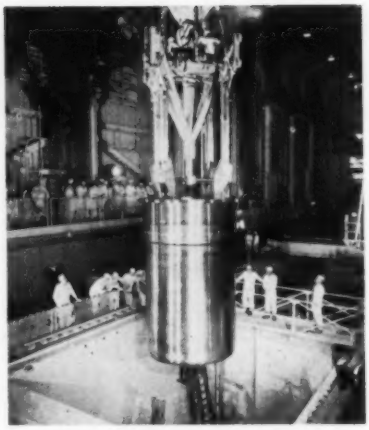
Both Feedall machines are available separately. There's extra economy, too, in the flexible designs which can be readily adapted to special needs.

Details can be obtained in the latest Feedall catalog, complete with estimate data sheet. Write for your copy . . . or send us sample parts and include brief facts. Our engineers will do the rest, promptly.

Feedall

Producers of automatic feeding devices
FEEDALL, INC., WILLOUGHBY, OHIO

ELEVATING, BLADE, TUMBLE, VIBRATORY FEEDERS • TRANSFER AND ELEVATING CONVEYORS • SPECIAL SELECTOR DEVICES



NUCLEAR core of the nation's first full-scale atomic electric generating station is lowered into position by engineers of Duquesne Light Co. and Westinghouse Electric Corp. The nuclear furnace will heat high-pressure water for use in a heat exchanger, turning a second supply of water into steam for driving a 100,000 kw turbine generator. The 58 ton core fits into the reactor vessel with a clearance between the two of only 0.06 inch.

ribbon consists of a resistance element of high nickel content alloy wire encased in a flexible outer covering. Less than 0.020 inch thick, the ribbon may be cemented to flat, cylindrical, or irregular surfaces. Self adhering types are also available. Designed to operate over wide temperature ranges, at high altitudes, and under severe physical conditions, thermal ribbons are manufactured in several shapes and sizes.

Electronic Components Available By Mail

MAIL ORDER service for a variety of electronic and electromechanical components on a direct customer service basis has been adopted by the Mechatrol Div. in the Components Group of Servomechanisms Inc., New York and Los Angeles.

Servomechanisms Inc. will make available through a catalog a single source of more than 200 components used in control equipment for automatic operations. The equipment will include precision amplifiers, potentiometers, modulators, power supplies, 60 and 400 cycle motors, synchros, precision breadboard equipment and a variety of packaged units. The

Circle 662 on Page 17

NEW EQUIPMENT • NEW COMPONENTS • CATALOGS & LITERATURE • ADVERTISED PRODUCTS • EXTRA COPIES OF ARTICLES OR SERVICES

starts on page 83 starts on page 113 starts on page 145

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403	433	463	493	523	553	583	613	643	673	703	733	763	793
404	434	464	494	524	554	584	614	644	674	704	734	764	794
405	435	465	495	525	555	585	615	645	675	705	735	675	795
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412	442	472	502	532	562	592	622	652	682	712	742	772	802
413	443	473	503	533	563	593	623	653	683	713	743	773	803
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418	448	478	508	538	568	598	628	658	688	718	748	778	808
419	449	479	509	539	569	599	629	659	689	719	749	779	809
420	450	480	510	540	570	600	630	660	690	720	750	780	810
421	451	481	511	541	571	601	631	661	691	721	751	781	811
422	452	482	512	542	572	602	632	662	692	722	752	782	812
423	453	483	513	543	573	603	633	663	693	723	753	783	813
424	454	484	514	544	574	604	634	664	694	724	754	784	814
425	455	485	515	545	575	605	635	665	695	725	755	785	815
426	456	486	516	546	576	606	636	666	696	726	756	786	816
427	457	487	517	547	577	607	637	667	697	727	757	787	817
428	458	488	518	548	578	608	638	668	698	728	758	788	818
429	459	489	519	549	579	609	639	669	699	729	759	789	819
430	460	490	520	550	580	610	640	670	700	730	760	790	820

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AUTOMATION

Information Service

For your convenience, advertisements and items of information on new equipment, components and manufacturers' literature can be quickly identified by an *Item Number* accompanying each unit.

For additional free information circle item number on an inquiry card. Fill in your name, title, address, etc.—Drop it in the mail—No Postage Required—Your request will receive prompt attention and will be filled directly by the manufacturer.

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Reader's Service Dept.

Mechatrol Div. will stock not only its own equipment and components but also those of other manufacturers. The catalog will include an introduction which will indicate the selection of proper components for a specific end.

Immediate mail delivery of items ordered from the catalog is planned. Sales engineers will be available to answer inquires and to assist in the selection of proper components. Items which require special engineering will not be available through the new service.

Servomechanisms Inc., is a designer of complex electronic and electromechanical components and sub-systems with plants on both the East and West Coasts.

DEPARTMENT store data processing system has been installed at Burdine's in Miami. The system consists of 43 Transactors manufactured by Clary Corp. and a Royal McBee computer. Transactor automatically prints the customer's sales check and at the same time punches sales information onto a tape. Tape is fed to computer which provides store with a complete picture of daily business. Customer service has been speeded since sales books and hand written receipts are eliminated.

Wire Stripping Technique

CENTERSTRIPPING of stranded or solid conductors of any gage is offered by the Manger Electric Co., Stamford, Conn., as one of its wire processing services.

Specialized equipment developed by the company strips portions of insulation from the conductor at either regular or irregular inter-

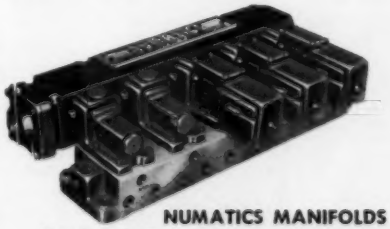
Specify NUMATICS VALVES

...there are no "equivalents"

SAFETY...

surpassing any other air valve on the market

In a momentary contact valve application, safety . . . for operator and machine alike . . . depends on a valve that will not shift when de-energized. Numatics DSA4 valves *can't* shift. Numatics exclusive detent does the trick . . . it safely, positively locks the valve spool in position the split second the valve is de-energized. What's more, this locking action is independent of air pressure, friction or packing drag. Numatics momentary contact air valves are, *in fact,* safer, more dependable than any other valves currently on the market. Write for complete information today.



NUMATICS MANIFOLDS

Numatics individual exhaust and conduit manifolds provide perfect "running mates" for Numatics solenoid actuated valves.

4-WAY HAND VALVES

For the utmost reliability and versatility, look first to Numatics 4-way hand valves. 136 models in 4 pipe sizes, a valve for every application.

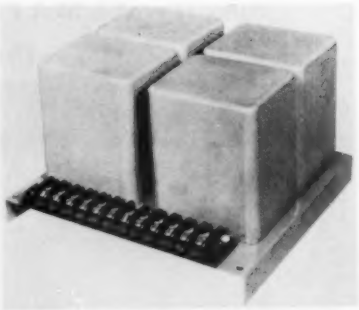
NUMATICS, Inc. MILFORD, MICHIGAN
Dept. A

Circle 663 on Page 17

vals throughout the length of the wire. Leads can be cut, end-stripped, and centerstripped as required, or can be supplied in a continuous coil.

Centerstripping is of particular interest to manufacturers of products where multiple banks of electrical components have common terminal points. One continuous centerstripped wire could be used in place of two or more single leads resulting in neater, faster assembly and lower installation costs.

PURCHASE of the stock of Hannifin Corp. by the Parker Appliance Co. has been announced by **S. B. Taylor,** president of Parker and **E. G. Peterson,** president of Hannifin. Parker makes many types of products, principally for the aircraft field, which are used to control or confine the flow of liquids under pressure. Hannifin is a well known manufacturer of hydraulic and pneumatic cylinders, presses and various related components. The acquisition is aimed at developing a balanced line of complementary products for Parker equally distributed between defense and industrial fields. The new organization will be known as Parker-Hannifin Corp.



PRESS control with no moving parts has been announced by Clark Controller Co. for use with its Type PV protector air valve. The 115 ac Transmag anti-repeat control utilizes magnetic amplifiers, diodes, a transistor, and a pulse transformer and is not subject to corrosion or dust interference. It receives input signals from the press operating push-buttons and limit switches, and delivers its output to the magnet of the Type PV air valve. Essentially a safety device, the Transmag press control prevents operation of press unless safe conditions exist.

Seek Refined Measuring Means

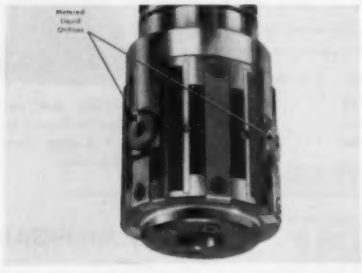
GOVERNMENT and industry metrologists, scientists and engineers are trying to break through present limits and split the inch to the seventh decimal place—0.0000001 of an inch. Congress has appropriated $75,000 to be used by the Bureau of Standards in this effort. Co-operating and working with the Bureau in contributing both money and research facilities are many of the nation's leading industrial organizations.

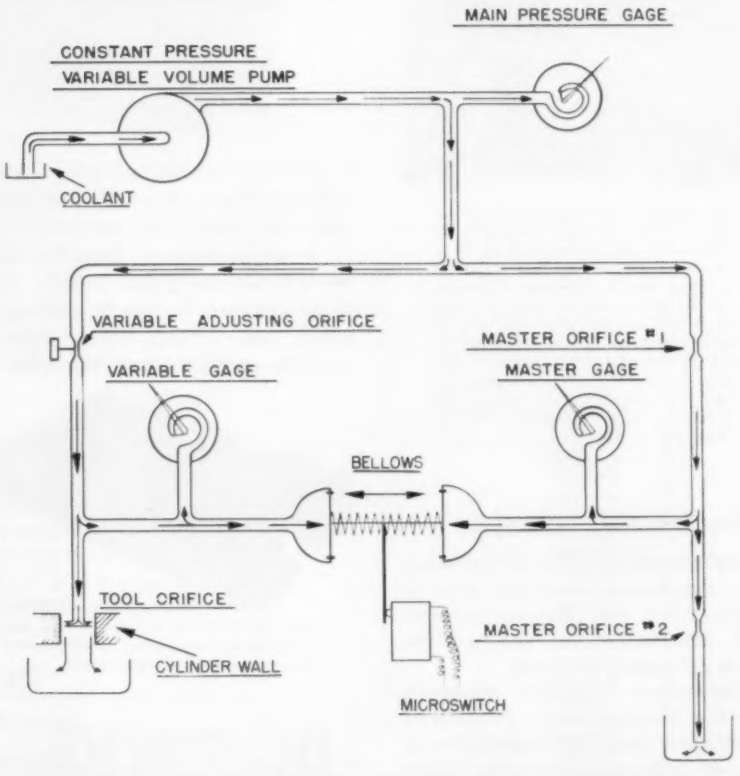
The companies participating or interested in participating include: The Sheffield Corp., Ford Motor Co., New Departure Div., General Motors Corp., General Electric, International Business Machines, DuPont, Van Keuren, Dearborn Gage, Taft-Pierce, Pratt & Whitney, DoAll Corp., Hughes Aircraft, Greenfield Tap & Die and Timken.

The prime objective of the program is twofold: (1) To develop master gage blocks—metal measurement bars—that can be reliably and absolutely stabilized to one tenth of a millionth of an inch. This is necessary because the present masters usually can be stabil-

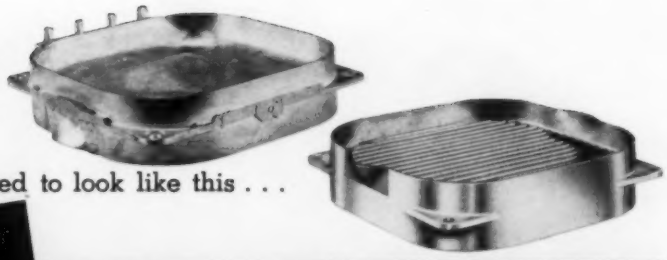
Automatic Gaging of Bore Diameters

AS HONING progresses, automatic gaging of bore diameters occurs with system developed by Barnes Drill Co. As shown by the schematic drawing, coolant is supplied at a constant pressure to both the tool and the master gage. Back pressure created by forcing coolant between the tool and walls of cylinder affects the expansion of the bellows. As hole enlarges, causing back pressure to decrease and bellows to expand, the point is reached where the variable pressure balances with the pre-set pressure on the master gage, at which time a limit switch is tripped to conclude the honing cycle after a final pass. If at any point the bore is not to size, the switch reactivates the cycle and honing continues until the entire bore is to size.





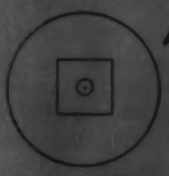
when you have parts of aluminum or other nonferrous metals . . .



that must be side, face or contour milled to look like this . . .

You can do the job better, far faster and at much less cost with an Onsrud **ROTARY FEED HIGH SPEED MILLING MACHINE**

WORK SET-UPS LIKE THESE . . . PART OF THE PRODUCTION ADVANTAGES OF ONSRUD ROTARY FEED MILLING



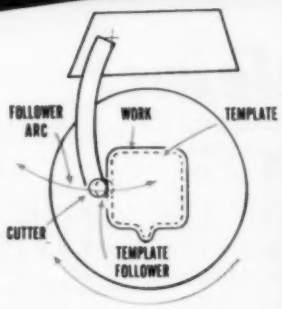
ALL FOUR SIDES IN ONE SET-UP

Work held by pneumatic center clamp, for milling completely around the part if desired.

CONTINUOUS PRODUCTION

Work fixture built with two, three or four (or more) stations for continuous feed of work to cutter. Operator merely loads and unloads without production time loss.

Guide roller mounted on pivoted arm follows template, moves to any point of follower arc to vary cutter head position as required, as table rotates to feed work through complete milling cycle.



Here is one of several Onsrud Rotary Feed Milling Machine models . . . a design type that has become the most versatile and productive in metal milling. The kinds of production parts that can be milled to advantage are almost endless in number . . . wherever the operation involves straight line or contour side milling or horizontal top-edge milling. The A-50AE machine shown here has a capacity for work up to 40" diameter. A high speed milling head with Onsrud two speed 7½/3¾ HP, 3600/1800 RPM air cooled motor gives proper cutter speed for fine finish and rapid feed. Other models supplied to fit work requirements as needed.

Write for Information

Let us tell you how Onsrud Rotary Feed Milling Machines can lower your production costs . . . in aluminum and related nonferrous milling. We'll also be glad to give you information on all other Onsrud milling machines for every type of production milling. Your inquiry is cordially invited.

ONSRUD
MACHINE WORKS, INC.
MACHINE TOOL DIVISION
7714 LEHIGH AVENUE (SUBURB OF CHICAGO) NILES 31, ILLINOIS

Onsrud® High Speed MILLING MACHINES for Aluminum and Related Nonferrous Metal Milling

For doing things *better* by doing things *differently!*

Circle 664 on Page 17

Speed Control Problems?

Let the Dynamatic Man Help You . . . He's an Expert!

More than likely the Dynamatic representative in your locality has had experience with a speed control problem about the same as yours. At any rate, he'll be glad to sit down with you and help work out the most practical and economical solution.

Dynamatic Eddy-Current Equipment—Drives, Brakes, Couplings—is solving speed control problems in every major industry, both in factory installations and on new equipment. Almost certainly some combination of these units will solve YOUR problem.

Your Dynamatic representative is fully qualified to make an intelligent appraisal of your problem, and suggest an application of Dynamatic Equipment that will do the most effective job for you. He has the background and experience to approach your problem with complete understanding. Why not call or wire the Dynamatic representative nearest you today—there's no obligation.

Illustrated Literature Describing Dynamatic Speed Control Equipment is Yours for the Asking

EATON DYNAMATIC DIVISION MANUFACTURING COMPANY Kenosha, Wisconsin

CALL THE DYNAMATIC® REPRESENTATIVE NEAREST YOU

ATLANTA, GEORGIA
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The Gearhart Bldg.

BALTIMORE, MARYLAND
Eaton Manufacturing Company
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BIRMINGHAM, ALABAMA
Eugene T. Sharley
Homewood Station, Box 5987

BUFFALO, NEW YORK
H. H. Cardozo, 5469 Main Street

BUTTE, MONTANA
G. M. Wallace & Company, Box 208

CHARLESTON, WEST VIRGINIA
Henry E. Payne
918 Kanawha Blvd. East

CHARLOTTE, NORTH CAROLINA
Electro-Motion Corp.
217 West Morehead Street

CHICAGO, ILLINOIS
Eaton Manufacturing Company
Arcade Bldg., One Riverside Rd.

CINCINNATI, OHIO
Gregg & Spohn, 1416 Bonnell Ave.

CLEVELAND, OHIO
Eaton Manufacturing Company
13600 Kuhlman Ave.

COLUMBUS, OHIO
Gregg & Spohn, 1738 Fifth Ave.

DALLAS, TEXAS
Lynn Elliott Company
1008 Fidelity Union Life Bldg.

DENVER, COLORADO
G. M. Wallace & Company
324 Denham Building

DETROIT, MICHIGAN
Eaton Manufacturing Company
10208 West McNichols Road

(Continued on following page)

DYNAMATIC REPRESENTATIVES
(Continued)

FLINT, MICHIGAN
Henry Electric Company
1209 Boston Ave.

GRAND RAPIDS, MICHIGAN
E. B. Dewey Company
314 Straight Ave., S.W.

HOUSTON, TEXAS
Lynn Elliott Company
371 M & M Building

INDIANAPOLIS, INDIANA
Gregg & Spahn, 5416 College Ave.

KALAMAZOO, MICHIGAN
E. B. Dewey Company
2519 Lake Street

KANSAS CITY, MISSOURI
Boyd Goodhart & Associates
Merchandise Mart Bldg., 2201 Grand Ave.

LOUISVILLE, KENTUCKY
Cardinal Carryor Co., Inc.
930 East Mason Street

MEMPHIS, TENNESSEE
Tom Jones, Mfr's Rep.
651 South Cooper Street

MIAMI, FLORIDA
The Gearhart Company
9731 Dominican Drive, Cutler Ridge

MILWAUKEE, WISCONSIN
Albert F. Korf & Company
3545 North Maryland Ave.

MINNEAPOLIS, MINNESOTA
Bemis Johnson Company
1645 Hennepin Ave.

MONTREAL, QUEBEC, CANADA
George Rumble Company, Ltd.
690 St. Paul St. West

NEW ORLEANS, LOUISIANA
Mid-South Sales Company
4424-B Earhart Boulevard

NEW YORK, NEW YORK
Gregg & Associates, U. S. Route 47,
Box 329, Caldwell Twp., New Jersey

NORTHBORO, MASSACHUSETTS
Machinery Electrification, Inc.
35 Hudson Street

PASADENA, CALIFORNIA
Shaw Engineering Sales Co., Box 590

PHILADELPHIA, PENNSYLVANIA
Eaton Manufacturing Company
5921 North Broad Street

PITTSBURGH, PENNSYLVANIA
J. A. Malady Company
4135 Brownsville Road

PORTLAND, OREGON
Donal Company, Box 7013

RICHMOND, VIRGINIA
Herbert J. Baer, 304 East Main Street

ROCHESTER, NEW YORK
H. H. Cardozo
414 Reynolds Arcade Bldg.

SAGINAW, MICHIGAN
Henry Electric Company
1716 South Jefferson

ST. LOUIS, MISSOURI
A. M. McIntyre, 8226 Buchanan

SALT LAKE CITY, UTAH
G. M. Wallace & Company
Continental Bank Bldg.

SAN FRANCISCO, CALIFORNIA
Monarch Corporation
55 New Montgomery Street

SAN LEANDRO, CALIFORNIA
Monarch Corporation, Supply Division

SANTA CLARA, CALIFORNIA
Monarch Corporation
2455 The Alameda

SANTURCE, PUERTO RICO
Ramon 1. Gil, Box 9182
Santurce Station

SEATTLE, WASHINGTON
Caskey Engineering Co.
2200 First Ave. South

STONERSVILLE, PENNSYLVANIA
E. F. Le Noir

TARIFFVILLE, CONNECTICUT
Gregg & Associates, 5 Fairfield Road

TORONTO, ONTARIO, CANADA
George Rumble Company, Ltd.
Terminal Building

VANCOUVER, BRITISH COLUMBIA, CANADA
Progressive Supplies Ltd.
360 West First Ave.

WASHINGTON, D.C.
Commercial Engineering Co.
1627 K Street N.W.

Circle 665 on Inquiry Card

CONVEYING system marketed by Durkopp Sewing Machine Corp., New York, for use in clothing and other industries. The material containers are carried to sewing positions on an inclined continuous conveyor track and are released electrically into the individual working areas. The control panel on the near end of the conveyor informs the supervisor of the container distribution at each work position. When work is completed on material in the container, the operator places the carrier onto the conveyor for further processing at other positions.

ized only to one millionth of an inch per inch of size. (2) A parallel objective, to improve present interferometers or light wave measuring instruments, so they can be used to give measurements accurately to one tenth of a millionth of an inch.

Success of the project will make possible more reliable and uniform gages and techniques. These in turn will mean more accurately fitted and mated manufactured parts and more efficient, trouble-free performance, decreased waste of high cost materials in production operations and more economies for both industrial and commercial users of manufactured products.

Tracer Control System Justifies Large Lathe

LARGE electronically controlled contour roll lathe has been ordered by Inland Steel Co. for its Indiana Harbor Works from the Mackintosh-Hemphill Div. of E. W. Bliss Co. The lathe, of nominal 60-inch swing and 25 feet between centers, will have an electronic follower control mechanism so sensitive that it can duplicate the contours of a master template within 0.001-inch.

Inland Steel will use the lathe for dressing back-up rolls and turning structural rolls. It will incorporate a number of special design features to speed setups and changeovers and to provide the extra power needed to turn up to 7-ton rolls. For example, it will be equipped with a power-traversed tailstock and power-traversed neck housings having hydraulic locking clamps. Moreover, its main motor will be rated at 150 hp, sufficient to provide a speed range from 0.17 rpm to 62 rpm through the heaviest depths of cut.

PUNCHED card formulation control has been developed by Richardson Scale Co. The unit can be actuated by IBM, Underwood Samas, or Remington-Rand type punch card. The two-piece unit consists of a card reader and a control system. A card is placed in the unit and a lever is manipulated to lock the card in place. When the start button on the control panel is pushed, the controls are capable of cycling any number of bulk materials through the various stages of weighing, discharge, mixing and conveying away for bagging.

3 WAYS YOU CAN KEEP

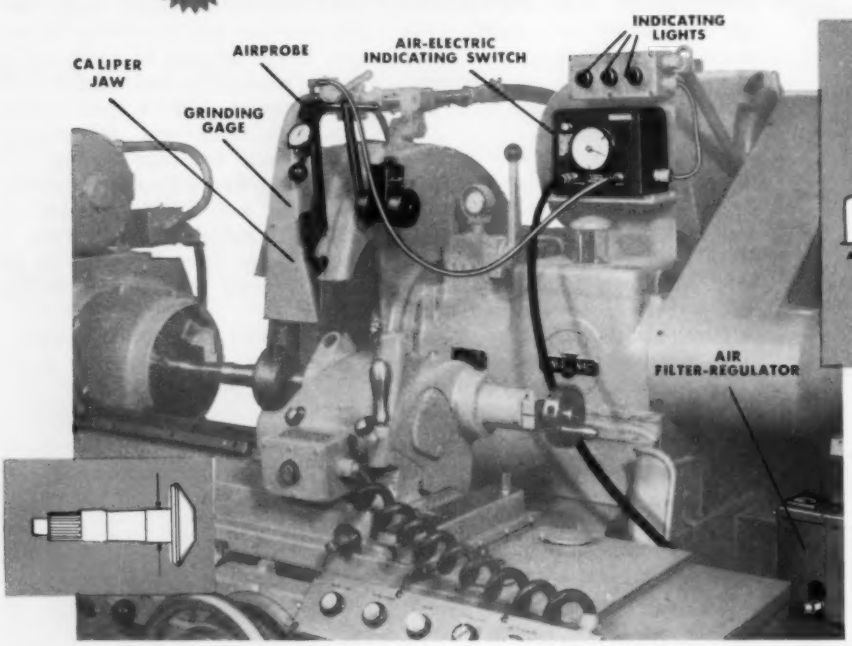
A BETTER PRODUCT . . . AT LESS COST . . . THROUGH ADVANCED GAGING . . . . . .

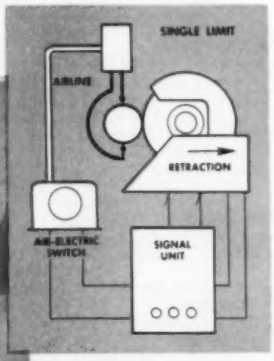
Profit margins aren't getting any better . . . just the opposite. With buying appetites fairly well satisfied, it's no longer a matter of "getting the stuff out". The problem now is making it *better at lower cost.* You certainly don't plan to let competition catch up to you. So consider these ways of improving product quality and, at the same time, cutting down on the cost per piece. Advanced gaging — by FEDERAL — can do it. The gaging ideas are proven profit makers. The gages, far from being monsters of automation, are compact, standardized units, realistically designed to provide automatic control or inspection, or both, where it does the most good and at a price that practically *every* manufacturer can afford. And they have reliability . . . the most important single feature of FEDERAL Gaging.

Whether you're big or small in terms of production, ***at least one of these gaging arrangements can pay off for you.*** *It's the truth. Ask us to prove it. Write:*

FEDERAL PRODUCTS CORPORATION
73911 Eddy Street, Providence 1, R. I.

1 AUTOMATIC CONTROL OF FINISH SIZE





This standardized control gage continuously measures and indicates size of work as it is being ground and automatically causes wheel to retract the instant finish size is reached. Unit can be easily applied in the field to any center type grinder having hydraulically controlled wheel slide. Quick delivery because all gage components are stocked.

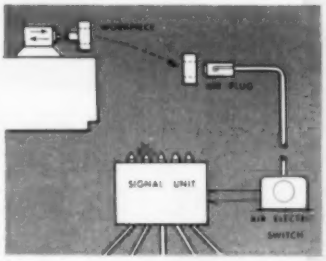
BENEFITS: *Reduces cost of operation — permits one operator to handle two, possibly three grinders performing the same or different operations. In this way gages pay for themselves within a few months.*

Improves quality — even if you have only one grinder, gage is a profit-maker because it eliminates error due to operator inattention or fatigue and also eliminates cost of later inspection. Gage never tires, is accurate to .0001" or better, is easily adjustable to control different sizes of work. Its Air-Electric system overlooks minor workpiece surface irregularities which confuse size readings of other gages.

VARIATIONS: *Similar FEDERAL Gages are available through machine tool manufacturers to also change wheel feed rate to dwell grind . . . or to control dressing cycle and finish size on I.D. grinders. When specifying machine tool requirements be sure to include* FEDERAL *Gaging.* FEDERAL *maintains close engineering alliance with all leading machine tool manufacturers.*

AHEAD OF COMPETITION

2 AUTOMATIC 100% INSPECTION

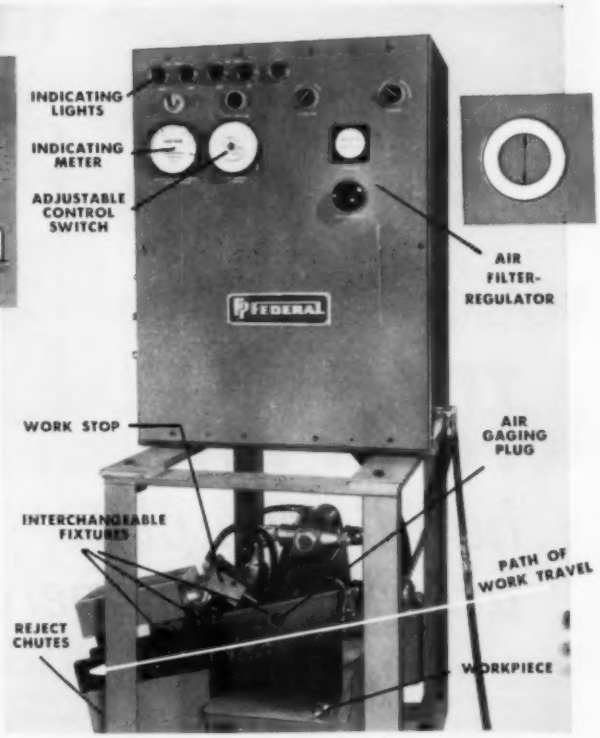


This standardized "post-process" gage inspects every part as it is discharged from the machine and sorts work into "good", "near-over", "near-under" plus "salvage" and "scrap", indicating the size of each piece as it is gaged. Operator, watching large indicating lights, can compensate machine for drift and piece-to-piece variation *before any scrap parts are produced.* Unit can be applied to any type I.D. or O.D. grinder, lathe, boring machine or screw machine. Gaging fixtures can be made interchangeable to handle various work sizes.

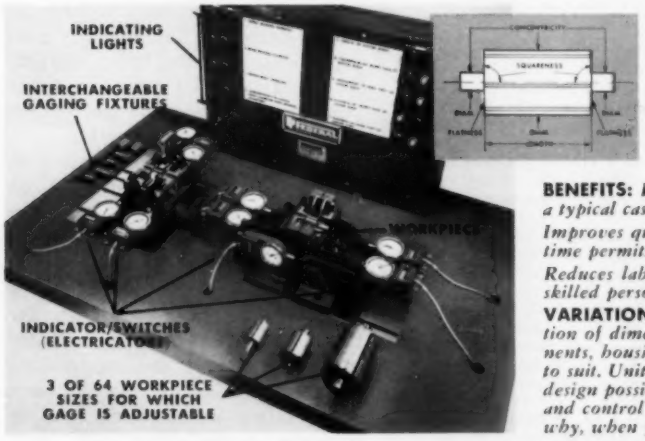
BENEFITS: *Lower cost per part. Gage virtually eliminates scrap by showing trend before tolerance limits are reached.*

Eliminates inspection errors — gage has 99.8% reliability or better as compared to about 92% for operator inspection and about 85% for inspection by other personnel.

VARIATIONS: FEDERAL *Gages of similar type are available through machine tool manufacturers to also provide automatic compensation of the machine, either proportionally or by increments, so that drift is corrected without need for operator attention. Moral: To get the maximum return for your investment, be sure to specify* FEDERAL *Gaging when you're buying machine tools.*



3 SEMI-AUTOMATIC, MULTIPLE DIMENSION MEASUREMENT



Ideal for small and medium production manufacturers, this gage checks nine dimensions in two stations and is adjustable for 64 different sizes! Work is loaded and disposed of manually. Lights show "good", "over" and "under". Units like this one have paid for themselves in well under six months.

BENEFITS: *Reduces non-productive costs — inspection time per part, in a typical case, is reduced 75%.*

Improves quality level. Inspection error is eliminated. Greatly reduced time permits profitable 100% inspection instead of sampling.

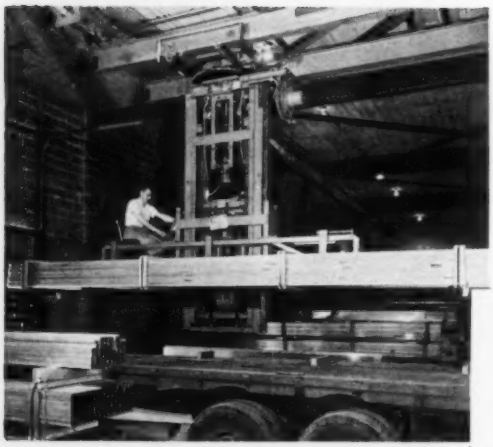
Reduces labor cost. Inspection can be performed satisfactorily by less skilled personnel.

VARIATIONS: *Unit can be designed to provide virtually any combination of dimensional measurements. Sensing elements, electrical components, housing and base are standardized. Other components designed to suit. Unit can incorporate semi-automatic disposal. Number of other design possibilities all the way up to a completely automated inspection and control gage. In every design the emphasis is on reliability. That's why, when you buy* FEDERAL *Gaging, you buy results.*

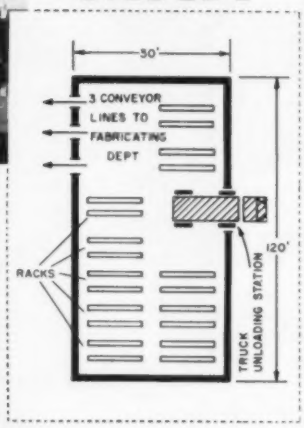
Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging



1 MAN ...and TRAK-RAK *handle complete warehousing operation*



UNLOADS TRUCKS, STORES MATERIAL IN 1 OPERATION

When the Per-Fit Products Corp., Indianapolis manufacturer of aluminum windows installed a Chicago Tramrail TRAK-RAK unit in its warehouse, it gained 4 big advantages:

1. **Increased the capacity of existing storage area.**
2. **Reduced handling costs by permitting 1 man to handle the entire warehouse.**
3. **Kept production lines supplied with on-time material deliveries.**
4. **Handled high grade aluminum extrusions without damage.**

The TRAK-RAK unit installed at Per-Fit consists of a 1 Ton capacity underrunning crane from which is suspended an electrically operated rotating telescoping column which is fitted with a three-fork carriage. All operations of the TRAK-RAK unit are controlled by the operator, who rides with the carriage. The unit serves a series of self-standing racks equipped with arms which receive the bundled material. Because the TRAK-RAK column requires minimum operating space, the aisles between racks are very narrow.

Trucks delivering material are unloaded (top picture) by the unit, which moves over the tops of the racks (below) to the proper rack and deposits its load in 1 operation. When a particular bundle is required by production, the operator moves to the rack, picks up the bundle, and, moving overhead, travels to the conveyor lines (drawing) and sets the bundle down on the designated conveyor line.

TRAK-RAK Systems of vertical storage and handling are saving time and money in warehouses and production plants of all types. *For complete details on how TRAK-RAK can help solve your problems, write:*

CHICAGO TRAMRAIL CORPORATION

1306 S. Kostner Avenue • Chicago 23, Illinois

CONVERTER which translates analog information characteristic of industrial processes—temperature, pressure, flow rate, etc.—into digital information has been developed by Weston Electrical Instrument Corp., a subsidiary of Daystrom Inc. The all-electronic device is expected to be of particular value to the chemical processing and petrochemical industry in view of the importance of continuous process control requirements and the increased interest in computer controls. The unit is not subject to the type of breakdown associated with conventional electro-mechanical converters.

Programmed Machine Provides Improved Tube Testing

AUTOMATIC electron tube analyzer has been demonstrated by the Electronics Div. of the Rheem Mfg. Co. The unit is a production and laboratory tube analyzer built to IBM specifications. It economically performs test operations which would normally require 15 skilled personnel and as many testing machines of the types currently available. Not only are fewer personnel required but use of less skilled personnel is possible.

Any one of 19 different tests on each of 17 possible test positions can be made, automatically or semiautomatically. Maximum production rate of 3000 tests per hour at a minimum accuracy of 3 per cent is possible. Provisions for three readout systems are included in the design of the equipment: Visual indication of whether tests are positive or negative; analog voltages representing the tests made on each tube; and IBM type punched cards.

In operation, the desired test sequence is established by a patch board which programs the tests for a particular tube type. Insertion of the tube by the operator starts the test which, on automatic

cycle, continues through the desired sequence of tests automatically. During the test of one tube, the operator can place a second tube into the machine which will underwgo the programmed test upon removal of the tube which has completed testing. A feature of the machine provides for automatic summation of the number of tubes tested, number accepted and number of IBM cards punched.

MEETINGS AND EVENTS

Nov. 7-8—

Third Electronic Business Systems Conference. To be held U. S. Grant Hotel, San Diego, Calif. Additional information may be obtained from Jac Wyman, Publicity Chairman, Third Electronic Business Systems Conference, P. O. Box 1448, San Diego 12, Calif.

Nov. 11-15—

National Electrical Manufacturers Association. Annual Meeting to be held at Traymore Hotel, Atlantic City, N. J. Additional information may be obtained from NEMA headquarters, 155 E. 44th St., New York 17, N. Y.

Nov. 13-15—

American Standards Association. Thirty-ninth Annual Meeting and Eighth National Conference on Standards to be held at the St. Francis Hotel, San Francisco. Additional information may be obtained from association headquarters, 70 E. 45th St., New York 17, N. Y.

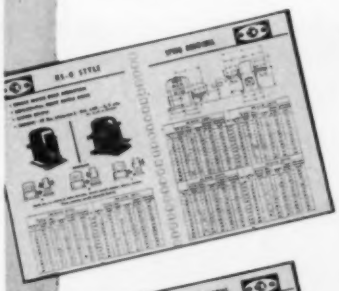
Nov. 18-20—

Conference on Magnetism and Magnetic Materials to be held at the Sheraton-Park Hotel, Washington. Sponsored by the American Institute of Electrical Engineers in co-operation with the American Physical Society; The American Institute of Mining, Metallurgical and Petroleum Engineers; The Institute of Radio Engineers; and the Office of Naval Research. Additional information may be obtained from L. R. Maxwell, Silver Spring, Md.

Dec. 1-6—

American Society of Mechanical

. . . is power-packed with 186 pages of complete information on how to calculate and plan the proper transmission for any drive problem. Contains valuable charts, tables and formula to help you select the right gears or speed reducers for the job.



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This section of the catalog gives you the specifications, dimensions and other vital information necessary to select the proper reducer in relation to required ratios, horsepower input, torque and space availability.

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This section of the catalog tabulates complete dimensions on Ohio standard spur, bevel, mitre, spiral, helical, worm and worm gears, and steel rack. Most items available with 14½ and 20 degree pressure angle.

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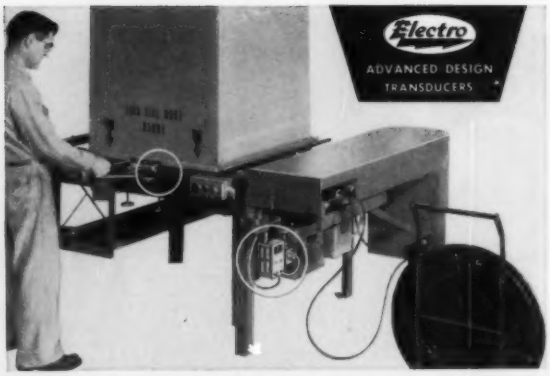

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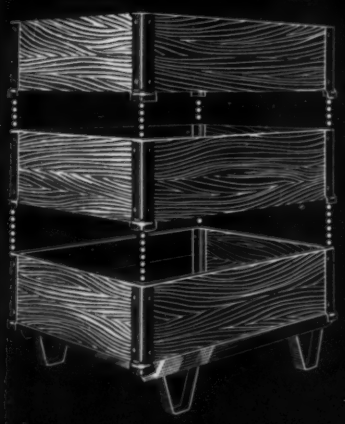

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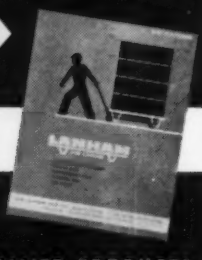

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Engineers. Annual meeting to be held Hotels Statler, Sheraton and McAlpin, New York City. Additional information may be obtained from society headquarters, 29 West 39th St., New York 18, N. Y.

Dec. 2-6—

Twenty - sixth Exposition of Chemical Industries. To be held New York Coliseum. Additional information may be obtained from exposition manager, E. K. Stevens, 480 Lexington Ave., New York 17, N. Y.

Dec. 9-13—

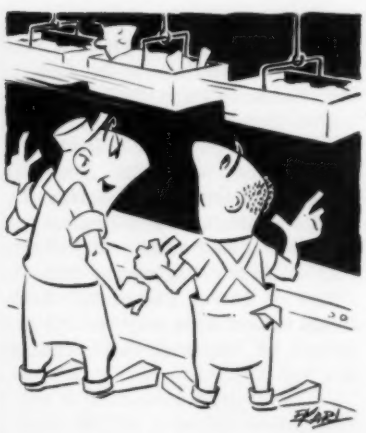
Eastern Joint Computer Conference & Exhibit. Co-sponsored by IRE, AIEE, and Association for Computing Machinery to be held Sheraton-Park Hotel, Washington, D. C. Additional information may be obtained from M. B. Catline, Council for Economic and Industry Research Inc., Arlington 2, Va.

Dec. 18-19—

Radio - Electronics - Television Manufacturers Association. Conference on maintainability of electronic equipment to be held University of Southern California, Los Angeles. Additional information may be obtained from association headquarters, 11 West 42nd St., New York 36, N. Y.

Jan. 27-30—

Plant Maintenance & Engineering Show. To be held at the International Amphitheatre, Chicago. Additional information is available from Clapp & Poliak Inc., 341 Madison Ave., New York 17, N. Y.



"The wife couldn't get a baby-sitter"

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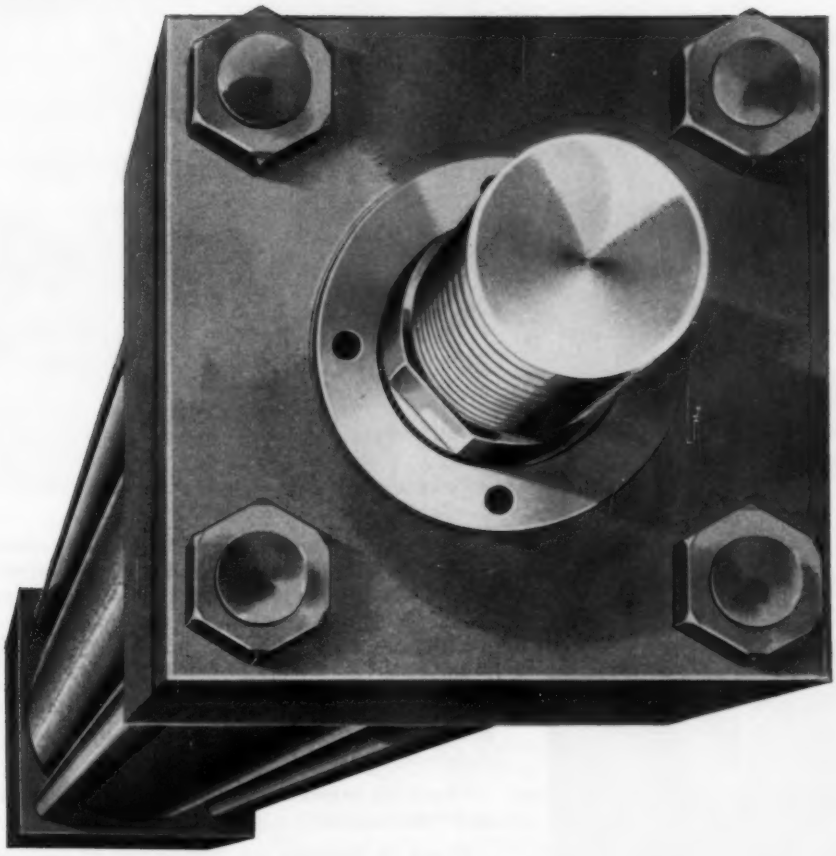
AT YOUR REQUEST...



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Announcing A *New* Approach to the Solution of Unusual Manufacturing Problems

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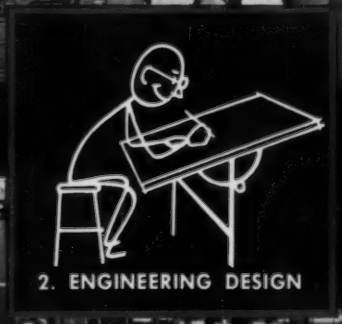

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This new four phase process development service, backed up by the know-how and experience of the Cross organization, will get results not available by any other means.

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Phase III covers equipment construction, testing and "de-bugging".

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By JAMES C. KEEBLER
Managing Editor

Candid shot of one of the round table sessions at the Second Conference on Manufacturing Automation. Suppliers and users of equipment were present to discuss their common interests in automation.

Reputable Customers

MUCH HAS been said and written about the advisability of dealing with reputable vendors. It is a good practice to be sure. One can assume that a vendor's past actions, which have accumulated to be his reputation in the field of his endeavor, give a good indication of his expected behavior. Chances are good that what he's done for others he can do for you.

Recognizing that the best sales are those transactions where both parties net a gain, it would appear that reputability on both sides of the deal would be highly desirable.

Around the Table

This point was discussed by the participants of a round table discussion on transfer machines at the Second AUTOMATION-Purdue Conference on Manufacturing.

As is usual at this annual conference, customers and vendors were both present to learn more about the ramifications and techniques of automation. The breakdown of the total enrollment into ten concurrent round table discussion groups enabled a freer interchange of ideas than was possible in the question periods following the presentation of papers. It's easier to submit your two cents worth in a group of 20 than it is in a ballroom full of people.

The round table on transfer machines was moderated by Chester S. Johns of the Buhr Machine Tool Co. In addition to discussion of many of the common technical aspects of transfer machines the circumstances of vendor-customer relationships came to the forefront.

It seems that both buyers and sellers of transfer machines share a growing realization of a need for better communication.

Men who buy transfer machines must be aware of, and not neglect to provide, information pertinent to the evaluation of the transfer machine application. On the other hand it is agreed that men who sell transfer machines must ask sufficient questions to accumulate information important to the preparation of a satisfactory proposal.

Transfer machine builders are compared to the honey bee—gathering knowhow as they progress from job to job and accumulating information that enables them to be better qualified to devise production equipment for new requirements.

Manufacturers that are seeking to upgrade their operations and reduce manufacturing costs can see here a great wealth of information that may be the key to an improved production process that hadn't occurred to them before.

To tap this source to the fullest extent calls for a great deal of understanding on the part of the buyer. On the one hand it would seem to his advantage to call in several vendors and ask each for a proposal without revealing to any of them his preconceived ideas of how the job should be done.

The advantage to this technique might be a number of fresh approaches to a problem. These would not be colored by prejudices of past experiences in the buyer's shop, and would benefit from the experiences the machine builder picked up elsewhere.

Secrets in Process

On the other hand these advantages may be offset by complications resulting from the lack of information on which to base the machine proposal. It is one thing to dream of new methods that sparkle from the lack of prejudices, and it is another thing to actually make them work in a shop where these prejudices do in fact exist.

The uninformed vendor may be wasting his time considering techniques that the buyer knows full well his shop has never been able to make work even though the vendor has seen it done elsewhere. There was ample indication in the round table discussions that the customer is more likely to get satisfaction if he gives the vendor a clear idea of what he thinks should be quoted.

Often a manufacturer has developed an approach to a problem that he considers to be unique enough to give him a competitive edge. If he suspects that the vendor will violate the confidence and directly disclose this knowhow to

←Circle 672 on Page 17

the competition he may keep the machine builder in the dark about many facets of the process that would materially assist in the design of the new machine.

To make the most of these circumstances and assure the customer's position, transfer machine buyers and sellers have been known to enter into agreements not to disclose design features to outside parties for a certain period of time. Often this in an informal agreement between the two and sometimes it is a written document.

Confidence and Trust

Ideally the customer should have rather complete confidence in his vendors. If they are not trustworthy enough to be told the necessary facts to do a proper job of making a proposal, it is hard to see how they could be trusted to build a proper machine.

We know a brain surgeon that takes this confidence issue so seriously that he won't cut open a fellow's head if he has reason to believe that the patient doubts his diagnosis or ability. Though this might be a healthy attitude for the machine builders to adopt, the advent of its becoming a reality is deterred by an enthusiastic desire to make a sale.

These round tablers seem agreed that the main ingredients required to make a reputable customer are the willingness to disclose all the facts of the problem to the prospective vendors, and the ability to clearly indicate what the vendor is expected to do so that each understands what conditions constitute satisfactory performance of the machine to be built.

Satisfaction Guaranteed or . . .

Incidents where a vendor is called back time and again to debug a machine to remove complications beyond his control—yet paid no fee for extra service on the grounds that it never really worked right in the first place—reveal a lack of understanding and lead to the conclusion that the customer has tendencies toward trying to get something for nothing.

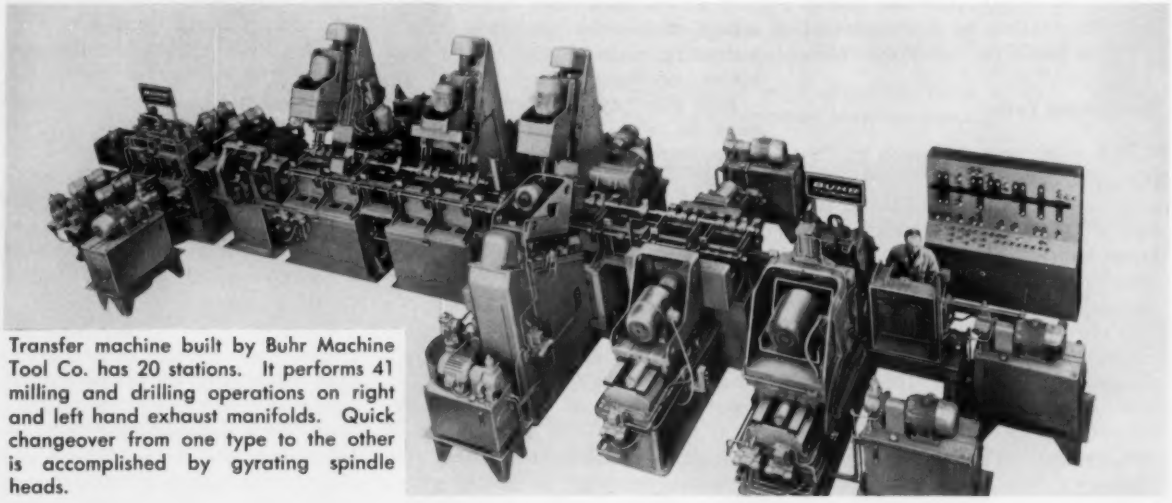
Such customers risk being classed with those who take the ideas gleaned from special machine builders' proposals and scurry around to a back alley shop to get a cheap version cobbled up. While there may be nothing unconstitutional about such practices, the customer that takes pains to build that sort of poor reputation should not be surprised to find it increasingly difficult to locate reputable vendors with time available to quote his jobs.

Realistic delivery dates are another point of concern. The customer that habitually assigns a reasonable time for his projects before closing the deals and then reschedules into absurdity and expedites ruthlessly is not much more of a shining example of ethical morality than the vendor that always quotes good deliveries to get the jobs then suffers *unavoidable* delays in making shipment. There should be a way to get these two together—they deserve each other.

The impression this observer gained is that most reputable customers recognize the difficulties involved in making an accurate cost estimate of a machine before the design is conceived, and are interested in working with vendors to establish more accurate estimating procedures. This understanding goes so far that they may buy without getting a fixed price quotation. Yet the desire to know costs early in the game leads to an expressed willingness to pay for proposals on new and unusual jobs provided there is an assurance of accuracy in the estimate.

Honesty is the Best . . .

Certainly the greatest strides toward more automation can be made from the greatest exchange of ideas. Reputable customers and vendors must build a feeling of confidence in doing business with each other—a confidence based on a fair exchange of ideas as well as a fair exchange of production equipment and money. If either has reason to suspect the other the relationship becomes shaky. Both parties involved in the sale of automation equipment stand to gain by better communication as to: 1. What is the job to be accomplished? 2. What kind of equipment is expected? 3. What constitutes satisfactory performance? 4. When will it be needed? 5. What will it cost?



Transfer machine built by Buhr Machine Tool Co. has 20 stations. It performs 41 milling and drilling operations on right and left hand exhaust manifolds. Quick changeover from one type to the other is accomplished by gyrating spindle heads.

ERIEZ MAGNA-RAIL UNITS SPEED UP CONVEYOR LINES, CONSERVE VALUABLE FLOOR SPACE!

Small, lifetime-powered magnetic automation elements fastened under conveyor belts provide safe, positive hold for ferrous parts; swiftly convey, control and elevate up inclines as steep as 80°; increase safety conditions and reduce damaged parts.

Speed up production and reduce operating costs with Eriez Magna-Rail! These units, fastened under existing lines or incorporated into new ones, turn ordinary belt conveyors into **magnetic** conveyor-elevators that are able to move ferrous materials and parts at greatly increased speeds.

Powerful magnetic action of Magna-Rails holds items such as nails, caps, cans, stampings, scrap, finished parts, etc. at fast speeds even up (or down) inclines as steep as 80°. Convey on both top and bottom sides of your lines . . . automatically turn conveyed parts over . . . change direction of flow, etc. Use of steeply inclined conveyor lines shortens belt lines, permits machines to be more closely grouped together. Positive hold prevents items from slipping off the line; improves safety conditions, reduces damaged parts.

Magna-Rail is a 4" wide assembly, standard lengths from 3' to 6', containing a series of Alnico V non-electric magnets. The unit is available in straight or curved sections for direction change of a conveyor line. Magna-Rail will **automatically** convey, control or elevate material from one machine (or operation) to another, with automatic discharge where required. When used with other Eriez HI-POWR magnetic equipment, these units offer unlimited automation advantages.

Lightweight and simple in design, Magna-Rails are easily incorporated into present conveyor lines. No outside power is needed, and maintenance is nil. Magnetic strength is guaranteed indefinitely.

• • • • • • • •

Eriez does not design, build or sell material-handling systems, *but we serve people who do* in areas where magnetic equipment should be incorporated. We willingly share the design-and field-application know-how gained through helping others move materials faster, more economically, more efficiently and more accurately by utilizing the inherent advantages of magnetism. Specifically, we produce standard lines of magnetic equipment and, in addition, design and build special components to *magnetically* convey, transfer, control, elevate, re-position, hold or re-orient basic ferrous material or finished parts. As our engineers work very closely with both system manufacturer and ultimate user, the most efficient installation is the end result.

ERIEZ MAGNA-RAIL UNITS PROVIDE THESE IMPORTANT AUTOMATION ADVANTAGES:

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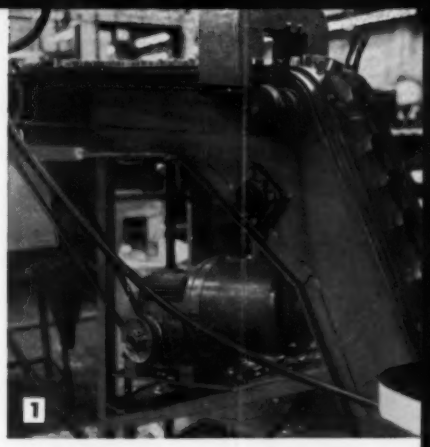
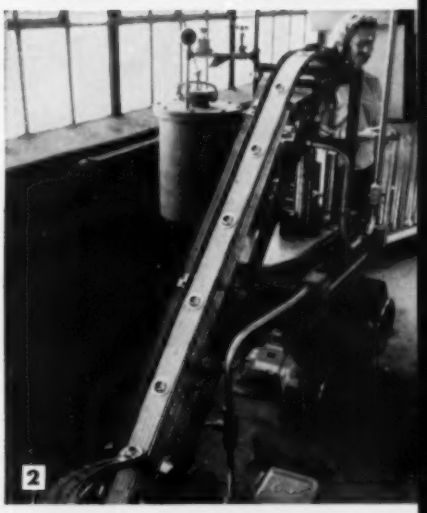
3. **R. T. French Company.** Problem: to elevate caps for mustard jars up a steep incline, over a conveyor line, and automatically release them into the hopper of a capping machine. Solution: MAGNA-RAIL
4. **National Can Company.** Problem: to convey can ends at the rate of 200 per minute from a press to a coater, without danger of the ends sliding off the line at this rate of feed. Solution: MAGNA-RAIL





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Lovejoy

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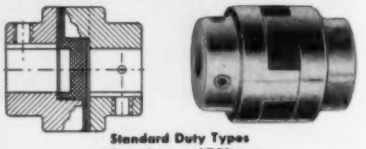
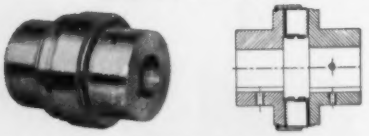
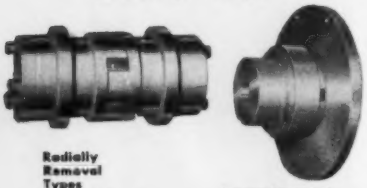
FLEXIBLE
COUPLINGS



Standard Duty Types
.05 to 40 hp. at 1750 rpm.



Medium and Heavy Duty Types
2.6 to 810 hp. at 100 rpm.



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Circle 674 on Page 17

AUTOMATION

problem forum

Readers with problems concerning systems, equipment or components for automated operations are invited to outline them to: The Editor, AUTOMATION, Penton Bldg., Cleveland 13, Ohio. Solution suggestions should refer to case number and title of the problem involved.

Case 1317-P
Reversing Motors

. . . We have been advised that some motor manufacturer is building a fractional horsepower motor which, as long as it continues to run, will run in one direction. Once stopped and then restarted it will automatically reverse and run in the opposite direction. Perhaps someone could advise us who manufactures same. We would appreciate any information you could furnish on this item. . .

Superintendent

• • •

Case 1325-P
Feeding Thin Materials

. . . We are interested in obtaining information on different methods of automatically feeding thin flexible material such as paper, cloth and leather. Any information on this subject would be sincerely appreciated. . .

Machinery manufacturer

• • •

Suggestions For 1076-P
Automatic Inspection Machine

. . . We are currently involved in an automatic inspection and testing machine for other electrical apparatus and would be very much interested in getting in contact with the individual concerned with this problem. . .

E. G. Reader
Ferguson Machine Corp.

•

. . . We have developed and built a similar device (see attached photo) for verifying the calibration on both push and pull spring forces on the tuner arm for auto radios for Radio Condenser Corp. We would appreciate an opportunity to review this problem. . .

Semond Levitt
Mechtronics Co.

•

. . . In reading the problem mentioned, the similarity between it and a machine which I designed for Motorola Inc. was at once apparent. My design checks and sorts thermostats at slightly lower but much more critical temperatures (plus or minus one-half degree centigrade). The machine automatically ejects the thermostats into bins of *set high, set low,* and *good.* I would be very happy to assist the manufacturer with the problem. . .

W. J. Ruh
Carpentersville, Ill.

• • •

Suggestions For 1037-P
Moisture Control

. . . We have many installations of this type used in the foundry industry. It is quite possible that we can adapt our foundry unit to the needs of your reader. Would it be possible for him to send us say a 400-lb sample. . .

Jess Toth
Harry W. Dietert Co.

•

. . . We have recently completed tests on a unit to measure the water content of various catalyst beds used in the petroleum industry. This unit is completely electronic, with no moving parts, and could be very simply modified to handle the measurements mentioned. . .

W. L. Chancey
KEMCO Inc.

•

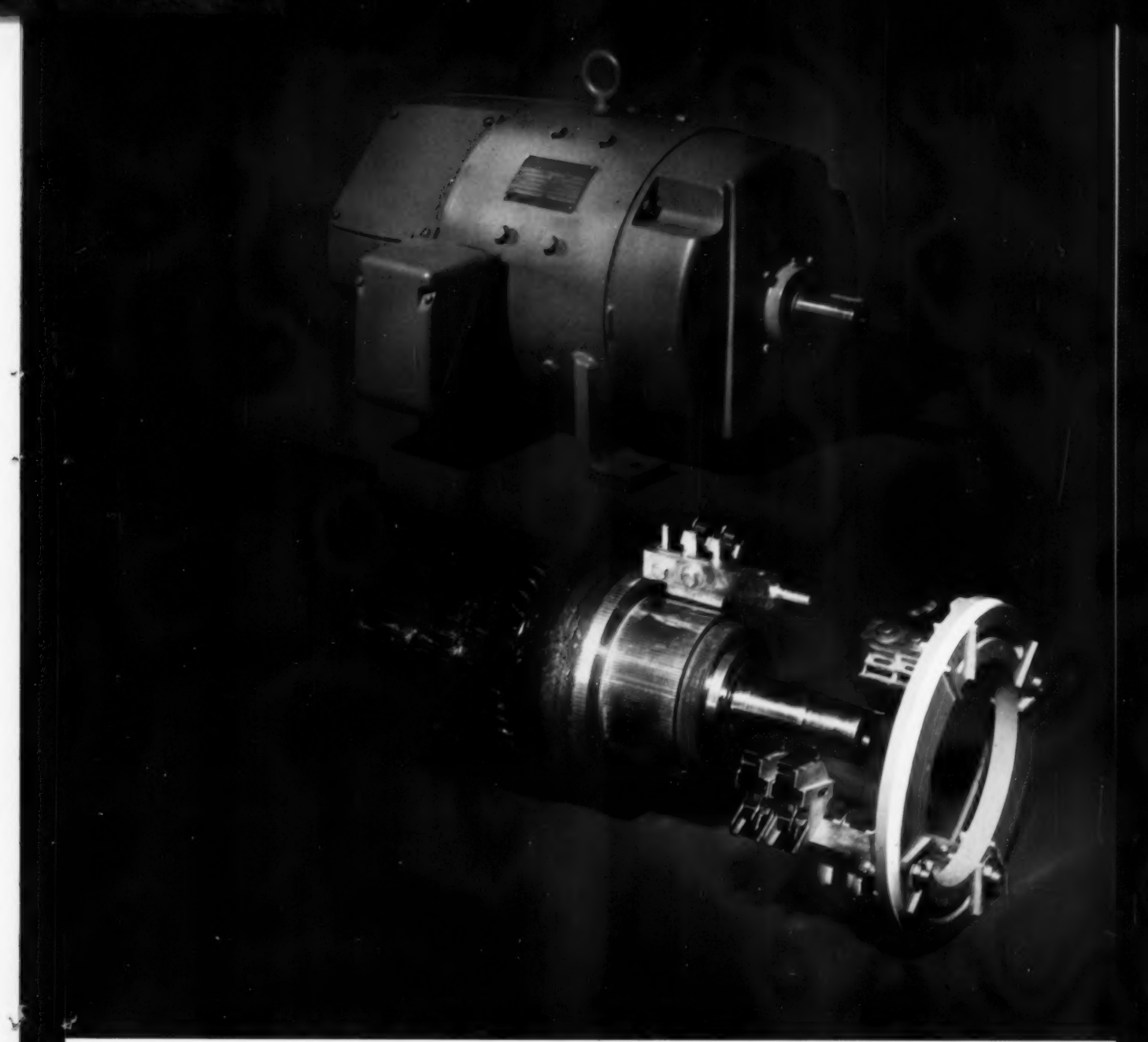
. . . We have a moisture control system for concrete mixtures. Perhaps this could be used on the above problem. . .

R. C. Cahill
Ramsey Engineering Co.

•

. . . Enclosed is a brochure describing the Quaker RMC Moisture Control system. This system is designed to continuously and automatically measure the moisture content of free-flowing granular material. . .

F. S. Mohr
Fielden Instrument Div.
Robertshaw-Fulton Controls Co.



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Proper Design Balance . . . means unmatched commutating ability . . . the ability to deliver the short bursts of power required for quick acceleration and deceleration. Fewer turns per armature coil . . . full complement of commutating poles . . . maximum number of commutator segments, combine to permit higher peak loads.

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D-c Kinamatic Motors offer a reliable key to successful automation. Additional information is available at your nearest General Electric Apparatus Sales Office. Or, if you prefer, write for Bulletin GEA-6355, *Direct Current Motor and Generator Department, Erie, Pennsylvania.*

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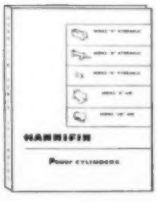
Write for your copy of this new Hannifin Cylinder File—complete, easy-to-use, easy-to-order-from information on five lines of Hannifin cylinders. Hannifin Corporation, 541 South Wolf Road, Des Plaines, Illinois.



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AUTOMATION

Somebody Else's Cost

Not only an effective tool for raising productivity, automation in addition offers unprecedented improvements in job opportunities for the future. However, increased productivity is a must in order to insure continuing advances in real wages regardless of interest in jobs.

Commenting on this important factor, Henry Hazlitt, in "Economics in One Lesson" states:

"In an exchange economy everybody's income is somebody else's cost. Every increase in hourly wages, unless and until compensated by an equal increase in hourly productivity, is an increase in the costs of production."

Much labor union discussion about automation has failed to include this important consideration. In presenting views on automation the assumption is made that it is a known force relentlessly invading industry. Today there is evidence to question this view. Successful automation requires considerable study and meticulous application. There is much that is not known or fully understood.

Recognition that automation and productivity offer much for workers was evidenced at the recent meeting of the Amalgamated Lithographers of America in Chicago. Reported in *Time*, the delegates adopted a proposal to set up a fund of $1 million to promote technological advances in lithography provided employers matched the sum.

Edward Swayduck, president of A.L.A., believes "Automation is a boon to workers, not a menace. If it helps get products to the consumer more cheaply, it's going to broaden activity in the industry and provide more jobs."

Productivity and automation are intimately related. With such serious study and co-operation they will continue to advance for all to benefit.

EDITOR

AUTOMATION

AUTOMATION ECONOMICS

REQUIRES ENGINEERED ACCOUNTING

"It is essential to allocate expenses according to their nature and not according to their present names." Thus a prominent engineering executive expresses his call for reform of accounting practice to eliminate the incongruity between present accounting methods and modern automation. The method set forth here for determining the conditions under which production will have minimum cost per unit is of interest to those involved in the economics of automation. Its value will be more clearly realized by those who substitute their own cost figures into the equations and study their solutions.

By **C. N. NEKLUTIN,** Vice President, Universal Match Corp., Director, Ferguson Machine Corp., St. Louis, Mo.

EVERY TIME a problem of mechanization arises, this question should be answered, "Is an additional investment justified?" Possible variations of this question are, "How soon can the invested capital be returned in savings?" and "What minimum volume of business is required to make the investment safe?"

After automatic machines are installed, the problem of proper utilization of equipment and personnel becomes most important, especially in cases when machines require changes of tools, or when set-up time is necessary for starting production. Therefore, engineers should be supplied with data to answer economic questions, or they should supply some definite information to some other department responsible for economic reports. Some technical information can be obtained from records, if they are kept by production personnel, but data concerning expenses should come from accountants.

In some cases the advantages of additional mechanization are so evident that even approximate calculations assure the safety of the investment. But quite often definite proof of the advantage of mechanization is almost impossible due to the necessity of depending on many assumptions in absence of reliable information.

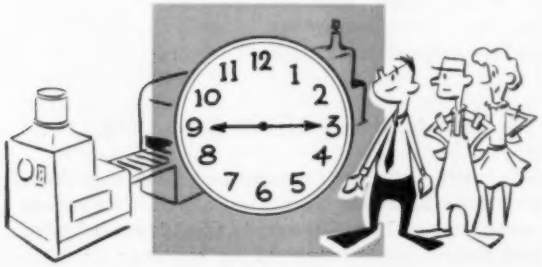
One of the possible reasons for such a situation is in the method of accounting. Accounting has been developed into a complicated science dealing

only with expenditures and income; this development was started when mechanization of production was practically unknown. Since the beginning of the present century cost accounting gradually became more and more necessary; it deals not only with expenditures but also with usage of machinery and with manufacturing processes which are in fields of engineering—industrial, mechanical, chemical, etc. Unfortunately, the method of handling expenditures was borrowed from accounting.

General accounting practice is to divide manufacturing expenses into three basic groups: Materials, raw and in process; direct labor; and burden. The latter covers a very large field; it includes everything other than direct labor and materials. Usually burden is divided into controllable (or variable) overhead and noncontrollable overhead. Each of these is distributed over one or more factors—as direct labor hours or dollars, materials in pounds or dollars, finished products, etc. So, large amounts of the burden are distributed arbitrarily. Many engineers connected with mechanized plants discovered that many accounting items which comprise burden are misnomers—at least from an engineering point of view. As an illustration, the controllable burden may have the following items: 1. Indirect labor (auxiliary, service labor). 2. Maintenance labor (technicians). 3. Maintenance supplies (replacement parts). 4. Utilities (fuel, water, electric power). 5. Supervision. 6. Clerks. These items are handled differently than so-called direct labor. Let's look at the *actual* conditions at the plants with mechanized equipment.

Automatic or semiautomatic machines cannot perform without a continuous supply of materials to be processed and a continuous removal of the processed products; therefore, persons and/or equipment performing these duties are *directly* involved in the manufacturing process and can be assigned to a certain department or group of machines.

Some manufacturing departments have auxiliary equipment which supplies production (assembling) machines with parts, packaging material, etc. Persons involved in auxiliary operations are *directly* connected with the performance of the department, though in some cases they are not directly connected with the number of production machines in use.



. . . after automatic machines are installed the proper utilization of equipment and personnel becomes most important . . .

. . . this work can be accomplished only with the full co-operation of accounting and engineering groups . . .

Some automatic machines require frequent adjustments and some of them require minor repairs and replacements during working hours. Therefore, certain groups of technical personnel (mechanics) are as essential for the proper operation of the equipment as machine operators.

Consumption of maintenance supplies (machine parts, tools, lubricants, etc.) is *directly* proportional to the use of machines (hours or cycles) and it also depends on the design of them.

Some utilities—steam, gas, compressed air—may be necessary for the manufacturing process; their use is connected with capacity of equipment and not with persons classified as direct labor.

Electric energy is used mostly for motors, heaters, controls; its use is proportional to the demand of the equipment and to the time of operation.

Even supervision and clerical help varies between different departments—some require very little paperwork and can operate on a few instructions, while others may need continuous supervision and recording of details.

As plants become more and more mechanized, the ratio of present burden to direct labor increases; arbitrary distribution of the greater part of expenses may lead to wrong conclusions in appraisal of economies or in estimations of cost. It is necessary to decrease the amounts which have to be distributed arbitrarily. To accomplish that it is essential to allocate expenses according to their nature and not according to their present names.

▶ According to Their Nature

In some plants it is possible to distribute burden between four basic groups:

1. Fixed or annual expenses, independent of the volume of production.

2. Expenses created by having a department in operation; they can be established per department-hour.

3. Expenses created by putting one machine or a group of interlocked machines in operation; they can be designated as machine-hour cost.

4. Expenses which are variable by nature, but cannot be allocated to departments or machines.

The word "department" is used advisedly—it may represent a line of machines making a cer-

tain product, or a separate building, or a so-called production center.

Annual expenses include expenses of top management, insurance, taxes, depreciation; they may include some indirect labor such as watchmen who have to be employed even if the plant is temporarily not in operation. In some instances the depreciation of equipment can be allocated to departments; a general upkeep of building may be included in this group of expenses. Generally speaking, the annual expenses are those which are necessary to keep the plant ready for operation. In one plant a man, listed conventionally as direct labor, was properly included in annual expenses because his presence was necessary at the plant independent of the volume of operation. Annual expenses are charged either against units produced, or pounds of materials used, or against the dollar cost of materials, or in a similar way permitting more or less realistic distribution of expenses which really represent a burden.

Department-hour expenses appear when a department or building or production line is in production. They are independent of the load which such department has to carry. Some expenses of this nature are created by auxiliary equipment—air compressors, pumps, or any pieces of equipment which are used, independent of the load on the department, but must be in operation as soon as the department is open.

Machine-hour expenses include direct labor, indirect labor, maintenance labor and supplies, utilities, compensation insurance, wage taxes, and any expenses which are proportional to the hours of operation of the machine.

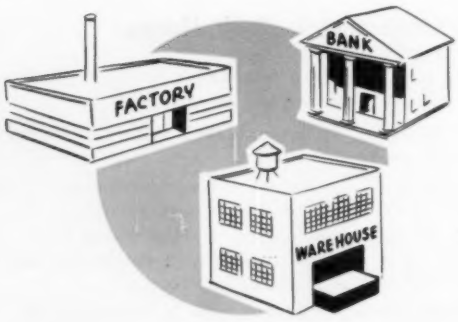
Undistributable (variable) expenses appear only when the plant is in operation; it is evident they are more or less proportional to production, but cannot be allocated to different departments. Examples of these are: Maintenance of miscellaneous equipment (interdepartmental conveyors, trucks, elevators). 2. Supplies for a central repair shop. 3. Office supplies. 4. Receiving and raw material handling (unless they are charged to the cost of materials).

Distribution of expenses varies from industry to industry and even from plant to plant, but the basic idea remains. *First,* expenses should be distributed not according to their names but according to the time and conditions when the expenses appear; and *second,* the amount of expenses which have to be distributed arbitrarily should be brought to a minimum. This work can be accomplished only with full co-operation between the accounting and the engineering groups.

NOMENCLATURE

C	— cost of production of a lot	cents
c	— cost of production of a unit	cents/unit
e	— total cost of a unit	cents/unit
F	— storage cost (floor space and handling)	cents/unit-month
f	— average unit cost of storage	cents/unit
H	— machine-hour cost (including direct labor, indirect labor, maintenance labor, and supplies, utilities, compensation insurance, wage taxes, and any expenses which are proportional to the hours of operation of the machine)	cents/hour
j	— average unit cost of interest on capital	cents/unit
M	— number of units required for one month's delivery to a customer or to another department of the plant	units/month
P	— actual production rate of the machine during the operation (may be lower than rated capacity)	units/hour
R	— cost of material (including raw material and added cost during previous operations)	cents/unit
S	— time for setup (including an average time for debugging)	hours
T	— unit cost of tools and/or auxiliary materials	cents/unit
t	— time required to produce a lot	hours
x	— number of monthly deliveries produced per setup of the machine	months
xM	— production quantity per setup	units
W	— cost of waste in setup	cents/setup

NOTE: If the produced items go through additional operations, the hourly production rate P should represent the actual production per hour minus estimated waste. Only items that enter the final product are counted.



. . . in many cases the minimum cost of production requires a large capital investment and a large storage area . . .

How to Use Realistic Accounting

It may be of value to present a practical problem which can be solved mathematically if certain data are available. It will illustrate what basic information should be available to an engineer or a supervisor facing a cost problem of this nature.

The problem is to find a minimum cost of production on a machine which requires a setup time

. . . a comparison of cost figures has a definite value when the difference between the standard and the actual cost is affected only by one major factor . . .

before initiation of production. To solve the problem theoretically it is necessary to include the cost of space for storage of produced items, including the cost of handling them, and the interest on capital tied up in stored items.

Both of these items are proportional to the time of storage; therefore the production is expressed in the number of units to be used (or shipped) during a certain period of time (month, week or day). The solution should give the number of these periods of time to be covered by the lot produced after one setup of the machine. To facilitate the reasoning, one month is selected as the basic period of time; if another period of time is used, only numerical values are changed.

Using the notation listed in the NOMENCLATURE: The time t required to produce a lot is equal to the setup time plus the total production time (total quantity divided by rate).

$$t = \left(S + \frac{xM}{P} \right)$$

Cost C of production of the lot is equal to the machine cost for the time required to produce the lot, plus the cost of waste in setup, plus the cost of tools for the lot, and the cost of material in the lot.

$$C = H \left(S + \frac{xM}{P} \right) + W + xMT + xMR$$

Cost c of production per unit is equal to the cost of production of the lot divided by the number of units in the lot. $c = C/xM$.

$$c = \frac{C}{xM} = \frac{HS + W}{xM} + \frac{H}{P} + T + R \quad \ldots\ldots\ldots (1)$$

Capital invested in the produced unit and the space for storing the lot will be used during $x/2$ months, considering the withdrawals are made in equal amounts and at equal intervals of time.

Average cost j of the interest on capital is equal to the cost of production per unit, times the monthly interest rate, times half the number of monthly deliveries.

$$j = \frac{i}{100} \cdot \frac{xc}{2}$$
$$= \frac{i}{200} \left[\frac{HS + W}{M} + x \left(\frac{H}{P} + T + R \right) \right] \quad \ldots\ldots (2)$$

Average unit cost f of storage is equal to monthly storage cost per unit, times half the number of monthly deliveries.

$$f = F \frac{x}{2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Total cost per unit e is equal to the sum of the cost of production, the cost of interest on capital, and the storage cost (sum of Equations 1, 2, and 3). Thus e

$$= \left(\frac{HS + W}{xM} + \frac{H}{P} + T + R \right) +$$
$$\frac{i}{200} \left[\frac{HS + W}{M} + x \left(\frac{H}{P} + T + R \right) \right] + F \frac{x}{2}$$
$$= \frac{HS + W}{xM} + \frac{H}{P} + T + R + \frac{i}{200} \left(\frac{HS + W}{M} \right) +$$
$$x \left[\frac{i}{200} \left(\frac{H}{P} + T + R \right) + \frac{F}{2} \right] \quad \ldots\ldots\ldots (4)$$

To determine the conditions for the minimum cost of one unit, take the first derivative de/dx and equate it to zero.

$$\frac{de}{dx} = -\frac{1}{x^2} \left(\frac{HS + W}{M} \right) +$$
$$\frac{1}{200} \left[i \left(\frac{H}{P} + T + R \right) + 100 F \right] = 0$$
$$x = \sqrt{\frac{HS + W}{M} \cdot \frac{200}{i \left(\frac{H}{P} + T + R \right) + 100 F}}$$

Designate all items describing conditions by one letter.

$$K = \frac{200(HS + W)}{i \left(\frac{H}{P} + T + R \right) + 100 F} \quad \ldots\ldots\ldots\ldots (5)$$

Then:

$$x = \sqrt{\frac{K}{M}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

The expression x shows the number of periods of time (in the example—the number of months) during which the produced lot will be utilized and the cost of it will be the lowest. The coefficient K of Equation 5 describes the influence of all properties of the machine, existing conditions at the plant, and costs of tools and materials.

In many cases the minimum cost of production requires a large capital investment and a large storage area. Therefore it is proper to find the cost variation when x varies from 1 to $\sqrt{K/M}$ by introducing values of x into Equation 1; it may be that the savings are very small in the vicinity of the minimum cost; then by allowing a slightly higher cost of production it is possible to decrease the working capital and the required storage area.

Similar analysis of cost variation when present equipment is compared with more mechanized equipment may indicate additional savings due to a decrease of setup time and waste, in addition to changes in labor force—direct, indirect, and technical. In industries producing bulky items it

. . . eliminate the incongruity between present accounting methods and modern automation . . .

may be practical to overrate the cost of storage, and also the calculation may give more practical results if the interest on capital is accepted higher than a regular bank rate.

This example illustrates the necessity of more detailed information available to engineers about elements of cost in mechanized plants and the necessity of some changes in present methods of accounting when a large portion of expenditures is allocated arbitrarily.

The suggested method of handling expenditures does not stop with the determination of fixed annual expenses, department-hour costs, and machine-hour costs. All these items can be used for making the annual budget for financial control; that budget is based on many assumptions such as the volume and kind of business, the efficiency of operations, and the level of expenditures.

For control of plants it is more practical to establish budgets based on the actual number of department-hours and machine-hours. This can be done on weekly or monthly bases, so that the factory budget is based on the actual load and not on assumptions. In mass production factories the annual budget can be used for establishing standard costs. Factory budget, based on actual hours used, permits the calculation of actual costs and the comparison of them with standards. The difference between them indicates, generally speaking, the efficiency of operations, because the hourly costs remain the same, but the actual output varies from the standard output assumed for making the standard budget.

Fixed annual expenses also can be distributed over actual production of the plant, and the difference between this cost and the cost of the fixed expenses in the annual budget indicates the influence of the volume of business on the cost.

All unit costs, or hourly charges, and fixed expenses are taken from accounting reports from the past, and each component of cost should carry the number of the account from which the expenses are taken. So each unit cost can be divided percentage-wise between the accounts; therefore, the factory budget, based on the actual load, can be easily distributed between the accounts.

The last step is the comparison of expenses, which are budgeted, with actual expenses—account by account or between groups of accounts. It can be done monthly, quarterly or semi-annually, depending on the practice accepted by the company. The difference also can be referred to the variation of cost of units produced in different departments or, in some cases, by the whole plant; it will indicate the influence of the level of expenses.

A comparison of cost figures has a definite value when the difference between the standard and the actual cost is affected only by one major factor.

It is understood that the description of this method may be too brief for specific guidance in certain individual applications because it is impossible to describe all possible details which can be found in different plants. The purpose of this article is to describe a general principle and general method for arriving at figures to appraise and finally, to control operations of plants.

THE AUTHOR

C. N. NEKLUTIN is widely known for his research into the theories of cam dynamics. As an engineer with Universal Match Corp., he conceived the idea of selecting a cam acceleration characteristic most suitable for the motion desired and then determining the velocity diagram and displacement chart mathematically by integration—at a time when the accepted method was to select a specified displacement characteristic and then to evaluate accelerations.

His development of cam principles, along with many innovations he introduced into the design of high speed machinery, printing presses and paper converting equipment, have been a contributing factor in making Universal Match the world's largest producer of matchbooks.

As vice-president, engineering, of Universal and a director of its machinery manufacturing subsidiary, Ferguson Machine Corp., Mr. Neklutin had a prime responsibility for two major reorganizations of the firm's production facilities to manufacture armament materials during World War II and the Korean conflict. Later, he established a system of cost accounting for the match company, based on principles discussed in the accompanying article.

Mr. Neklutin now serves Universal Match, its several subsidiaries, and their customers in a consultant capacity on matters pertaining to plant layout, production methods, special purpose machines, automatic assembly machines, and cams.

1

Construction progress photograph of the installation of twin grinding and polishing lines for plate glass. To achieve continuous production, tables that fit end-to-end move off the end of each line onto a turnaround section and go to the starting end of the other line. The discharge section of each line is equipped with a dynamic holdback arrangement that assures constant contact between the tables under all work stations. Main console control panel can be seen inside this turnaround section.

AUTOMATION TODAY

GRINDING AND POLISHING PLATE GLASS

MAMMOTH PRODUCTION quantities often require mammoth production facilities. So it is with the grinding and polishing of plate glass at the glass plant of the Ford Motor Co. at Nashville, Tenn. The installation — really two lines in one—produces ⅛-inch and ¼-inch ground and polished glass for automobile windshields and back windows.

Shaped like a race track, the line has 1842-foot straightaways joined at each end by 23-foot radius turnarounds. The resulting oval gives the twin production lines the appearance of being one continuous operation.

Huge cast steel tables move in continuous lines down the straight sections. At the end of each straight section a holdback arrangement assures that the tables in the straight sections remain in contact as they move under the grinding and polishing heads. As a table clears through the holdback section of one line it is accelerated onto the turnaround section where it is moved by a series of powered rollers around the end of the line and into position at the start of the next straight section.

The tables of each line are driven by five drive units. Each unit has dual, vertical pinions, directly opposite each other, which engage the rack under each table. These pinions are driven through reduction gearing by two 100-horsepower motors, mechanically coupled together through free-wheeling clutches. The free-wheeling clutches connect the drive motors to the pusher drive boxes and the drive boxes to the pinions driving the tables. The clutches permit free rotation of pinions if a drive box is idle, or if a motor is idle. The drive is designed so that an equal load is applied to all drive motors in operation at all times.

The drive to each line is controlled by variable voltage motors, providing a range in line speed for grinding and polishing glass from 100 inches per minute to a maximum speed in excess of 350 inches per minute. The speed is infinitely variable over the entire range. In addition to the pusher and holdback drives, there are supplementary

2

Table that has just come around the end at accelerated velocity is entering the *Closing* section where it will be pushed into engagement with the line of tables. Drive mechanism in this section decelerates the table to line velocity. The 124 tables required for each line are in constant contact from the *Pusher Drive* area to the *Holdback* area and form a solid surface 1775 feet long that supports the glass during the grinding and polishing operations. Four tables are in each turnaround section at all times, requiring a total of 256 tables for the system. Equipment is shown being installed at the Ford Motor Co.'s glass plant in Nashville, Tenn.

drives such as take-off, closing, auxiliary pusher, table separation control, and table synchronizing control. The purpose and function of each unit is as follows:

Take-Off: This separates the individual table from the continuous line of tables after it has cleared the holdback. Another function of this drive is to accelerate the individual table to turnaround velocity.

Closing: This takes the individual table as it comes from the turnaround and pushes it into engagement with the line of tables, prior to entering the pusher area. This drive also decelerates the table to line velocity.

Auxiliary Pusher: This maintains constant pressure on the tables as they enter the pusher drives. It also determines that contact has been made between the tables by the closing drive.

Table Separation Control: This automatically and continously checks the line of tables to assure that they do not separate through the pusher drive.

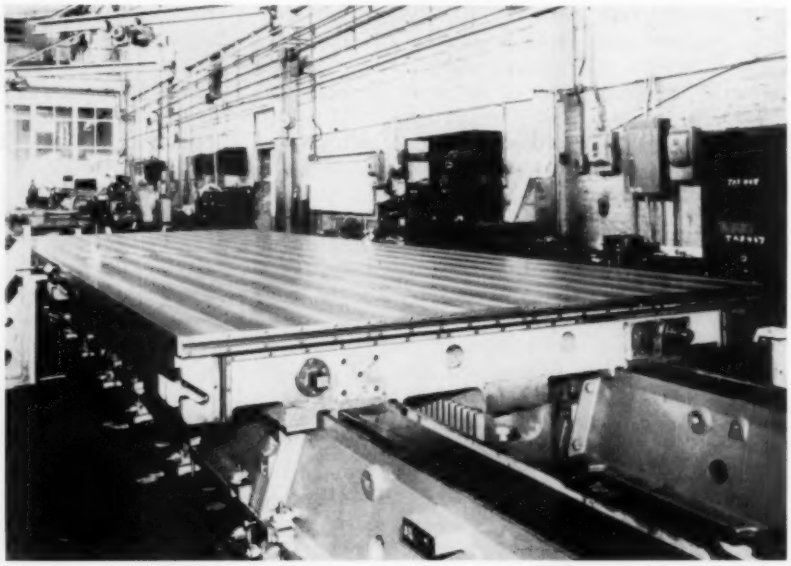
Table Synchronizing Control: This automatically positions the closing drive pinion so that the free table moving through the turnaround will engage its rack with the pinion. Engagement is made at turnaround velocity.

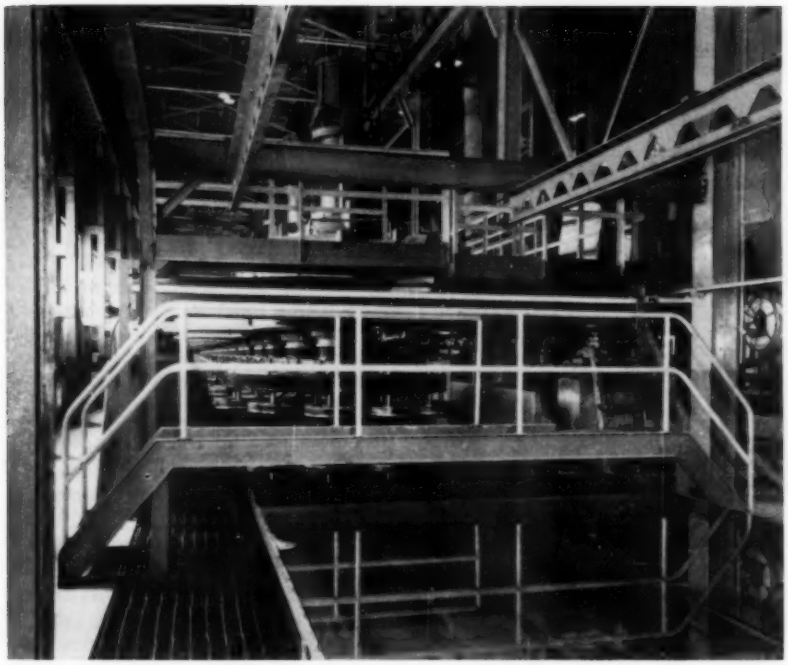
At least four powered rollers are under a table at all times during the turn cycle. Normal operation is timed for four tables to be in each turn at any time, but transfer cycle time can be decreased or increased to have three or five tables in the turn at one time.

The timing cycle begins at the instant a table is taken away at the holdback area and ends at the instant contact is made in the pusher drive

3

Grinding and polishing line equipment was built by the Hamilton Div., Baldwin-Lima-Hamilton Corp. This test setup was made in the builder's shop for checking tolerances and accuracy of machining. Flatness is held to a total indicator reading of 0.003 inch. Tops of these one-piece steel castings are machined to a tolerance of 0.004 inch as measured at both ends of the table. Square and round locators on table ends guarantee alignment of tables as they come together.





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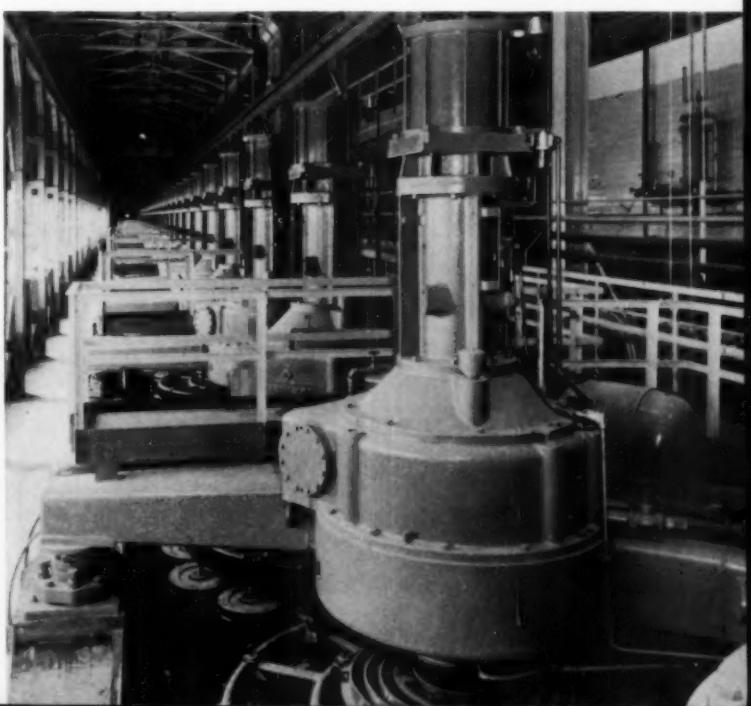
Tables are seen emerging from under the polishers on the east line. Each line incorporates a series of 32 grinders and 50 polishers. In this photo, tables are empty but covered with water. An integral trough projects 4 inches beyond the leading edge end-strip of each table. This trough slopes from the center downward toward the outside edges of the tables to prevent plaster, glass, and water from falling on the bedways.

area. At the instant of takeoff, the table is accelerated to turn speed—approximately 2½ times line speed—by the take-off pinion. Acceleration is complete before the table contacts the first powered roller.

As the table approaches the closing pinion, a dog on one side of the table contacts a dog on the table synchronizing rack. The rack synchronizes positioning of teeth in the closing pinion with those of the table rack to assure a smooth and positive mesh. After the table contacts the closing pinion at turnaround velocity, the closing pinion drive then takes over control of table velocity. The table continues, at turnaround velocity, to the optimum contact point where it is decelerated to slightly greater than line speed.

As the tables contact each other, an electrical inspection is made to assure that the gap between bumper plates does not exceed 0.020 inch. This gap is not detrimental to line operation, but the



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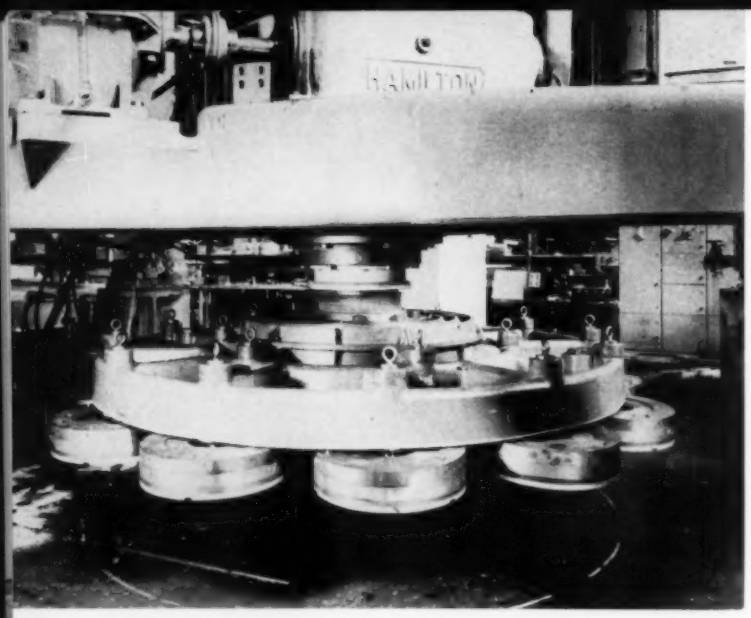
Grinders run at 48 rpm, polishers at 24 rpm. Drive motors for these are all 1150 rpm constant-speed alternating current motors with 100 hp for rough grinders, 75 for finish grinders, 125 for rough polishers and 75 for finish polishers. Direct connection of the grinding and polishing assembly heads to the drive motors through reduction units is an innovation. Other glass lines employ V-belt drives.



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Each polisher has a main drive spindle driving a spider containing 18 polishing assemblies. Each assembly consists of a spindle, polishing block, weights and adapter to which is cemented the felt, 1¾ inches thick, that contacts the glass. Rouge for use as a polishing agent is dispensed to the glass by an automatically timed system through a plastic rouge trough mounted atop the spider. A series of segmented laps contacts the glass and performs the surface grinding. These laps, somewhat kidney-shaped, are bolted to the lap driver which looks very much like a huge manhole cover. The lap driver, in turn, is attached to the main spindle.

accumulation of gaps must not exceed 0.060 inch. At a definite point beyond the optimum contact point the tables will either be synchronized for gap allowance or the line will stop.

Beds are lubricated by diagonal oil grooves running their entire length with cross feeder grooves spaced 10 inches apart. Individual pressured oil inlets—provided in the bed section for lubrication of both bedways—feed from each side. A cast trough with sloping sides, on the side of each bedway, collects the oil and directs it to the drain outlets. Drain pipes from these outlets then channel the oil back to the pit reservoirs.

Two pressured oil inlets supply the main spindle bearings. The oil then is collected in a sump cover at the base of the spindle and returned to the reservoirs. Each pinion is lubricated by a separate spray system with oil supplied from the corresponding bed side. The entire capacity of five rail tank cars of oil—33,250 gallons—is required to charge the lubrication system. A reclaiming type pressured oil system is incorporated for drive boxes, gear boxes, grinding and polishing heads and bedways. Manual lubricators are provided in the turnarounds.

The entire system incorporates safety features and devices to protect personnel from injury. Interlocks—both electrical and mechanical—are provided wherever necessary to prevent damage from conflicting motions.

Accompanying photos show the size and complexity of this automated system.

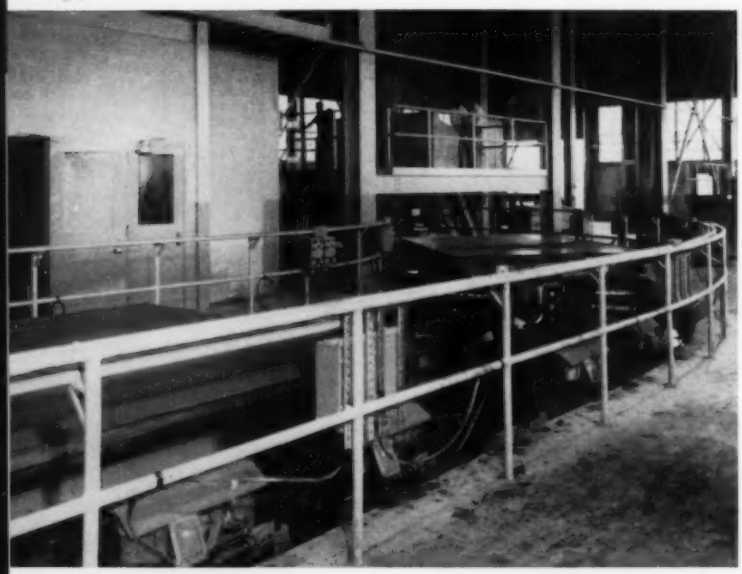

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Table is shown at end of line where it has entered turnaround section to be automatically transferred to the other grinding and polishing line. It is possible to insert, and remove a table at either end while the system is in operation at full speed. At 350 inches per minute the operator has 29.4 seconds to place a new table in the line. A crane is positioned to remove a table at the acceleration section and another crane is positioned over the insertion point at the closing section. When the preceding table passes the insertion point, the operator places the new table in the line, removes the hooks and starts the transfer rolls. The next table reaches this point in 29.4 seconds. Provisions are made at the north end to decrease line speed to 100 inches per minute should it be necessary to remove tables at less than line speed. This condition allows 103 seconds to perform the operation.

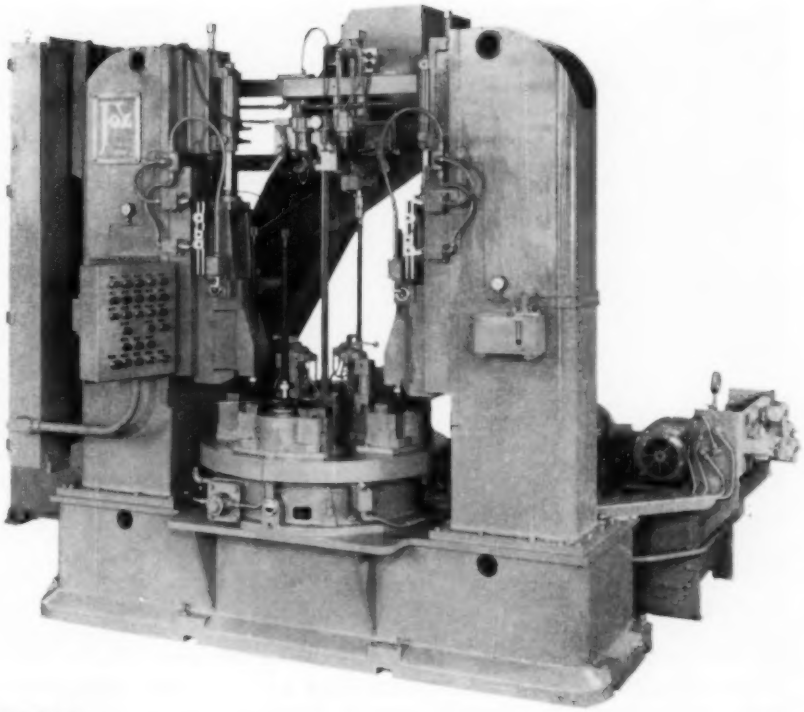


Fig. 1—Rotary index machine incorporating two hydraulic assembly presses, viewed from the operator's station. Table indexes clockwise. Station at operator's left is bearing press; station at rear is retainer loading point; station at operator's right is retainer press. Both presses are shown at bottom of stroke prior to reversal. Assembly in the operator's station has just been loaded.

ASSEMBLIES

PRESS-FIT AUTOMATICALLY

WITHIN SPECIFIED FORCES

PRESS-FIT ASSEMBLY is peculiar in that inspection of pressing force can only be done as a part of the assembly operation. When pressing one part onto another, maximum and minimum forces necessary for assembly are specified. The parts must not assemble with application of less than minimum press force and must not be assembled by application of greater than maximum allowable force. Obviously, this force can be measured only during the pressing operation. Once the assembly is completed, inspection of the fit is not feasible.

Because of this peculiarity, Fox Engineering Co. has incorporated 100 per cent inspection of press-fits into the automated assembly operation performed by the 4-station, automatic cycle hydraulic assembly machine shown in *Fig.* 1. The machine stops when assemblies have been press-fitted at less than minimum force or do not fit at maximum force.

The machine force-fits a bearing and retainer onto a rear axle shaft, *Fig.* 2, in a 4-station operation. Station 1 is the load-unload location, Station 2 the bearing press, Station 3 is where a retainer is automatically dropped over the shaft, and Station 4 is the retainer press. The bearing and a dust shield are placed over the shaft prior to loading at Station 1.

The presses at Station 2 and Station 4 have a nominal capacity of 7000 lb. Maximum force used on each press is set by the main relief valve on that press, *Fig.* 3. Although no maximum press force is specified for assembly of the retainer, the same maximum force is maintained as for the bearing so as to prevent the operator from using the retainer press to fit a tight bearing. Minimum force of 2700 lb is set by a supplementary relief valve which vents the main relief valve under control of a solenoid operated valve.

In the automatic cycle for each press, jaws close loosely around the axle shaft above the bearing or retainer and the ram extends under minimum pressure. In the normal case, the ram starts to press the bearing or retainer onto the shaft but does not complete the press because only low test pressure is available. After a fixed time delay, maximum

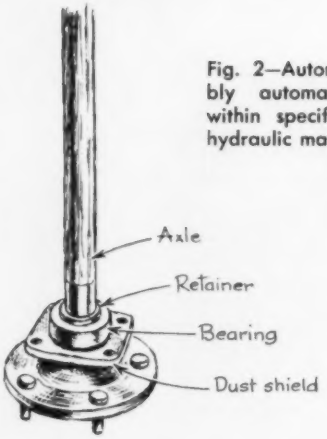


Fig. 2—Automotive axle assembly automatically press-fitted within specified forces on the hydraulic machine in *Fig.* 1.

pressure is applied and the ram extends to complete the assembly to press-fit depth. Another timer causes the ram to reverse to its normal or *Up* position and the ram jaws open.

Should the ram reach press-fit depth (indicated by a limit switch) before the time delay preceding application of maximum pressure, the assembly has failed the low pressure test. In this event the operation is interrupted and a ***Failed Lo*** signal light informs the operator of the condition.

If the ram has stopped short of the press fit depth limit switch after completion of a fixed period of high pressure application, the assembly has failed the high pressure test. Again, operation is interrupted and the operator is notified by a ***Failed Hi*** signal light.

At Station 3, a feed track is supplied with retainers by a floor mounted motorized hopper unit. Two pneumatic valves are utilized in the transfer and load cycle: One, solenoid operated, controls the air cylinder that actuates the loading ram to carry the retainer from the track to the end of the axle shaft; the other, cam operated, functions during the loading ram cycle to select a retainer at the end of the track and release it to the loading ram at the top of its stroke.

Separate hydraulic power units serve each of the two automatically cycled presses and the rotary index table. Three solenoid controlled hydraulic valves are used with the rotary table: One controls the fluid motor that rotates the table by means of a worm drive; the second actuates the table lockpin; and the third vents the pump relief valve when pressure is not required, minimizing heating of the hydraulic oil.

A Bijur automatic lubrication system is provided for the slide ways and jaw mechanism on each press. The lubricator for the bearing press also serves the feeder mechanism ways at Station 3; and the lubricator for the retainer press also serves the fixture clamp manifold device on the table centerpost. These two lubricators are hydraulically actuated when their respective presses cycle.

Fixtures contain interchangeable components so that they can be set up for several different axle shafts. Clamping is pneumatic wtih automatic release at Station 1 and manual release at the other three stations if required.

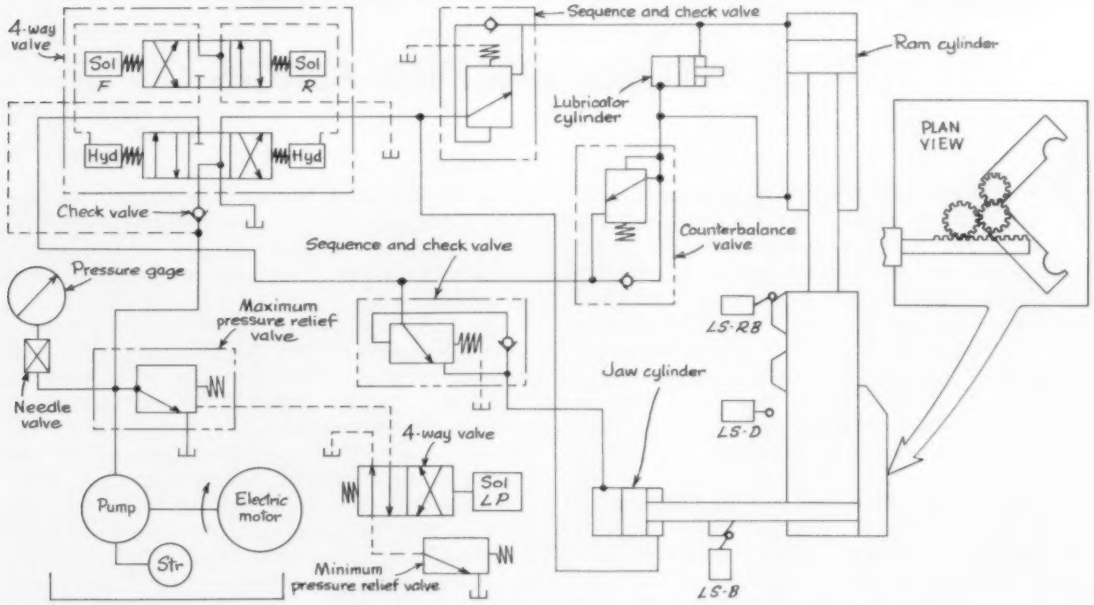


Fig. 3—Hydraulic circuit diagram for press to assemble parts under controlled minimum and maximum pressures. If the ram reaches the *LS-D* level before the low pressure timer completes its period, the assembly has failed the low pressure test. In this event, a *Failed Lo* signal light is illuminated and both solenoids *F* and *LP* are de-energized to stop the ram. If the ram has stopped short of the *LS-D* level after the high pressure timer has completed its period, the assembly has failed the high pressure test; a *Failed Hi* signal light is illuminated and solenoid *F* is de-energized to stop the ram.

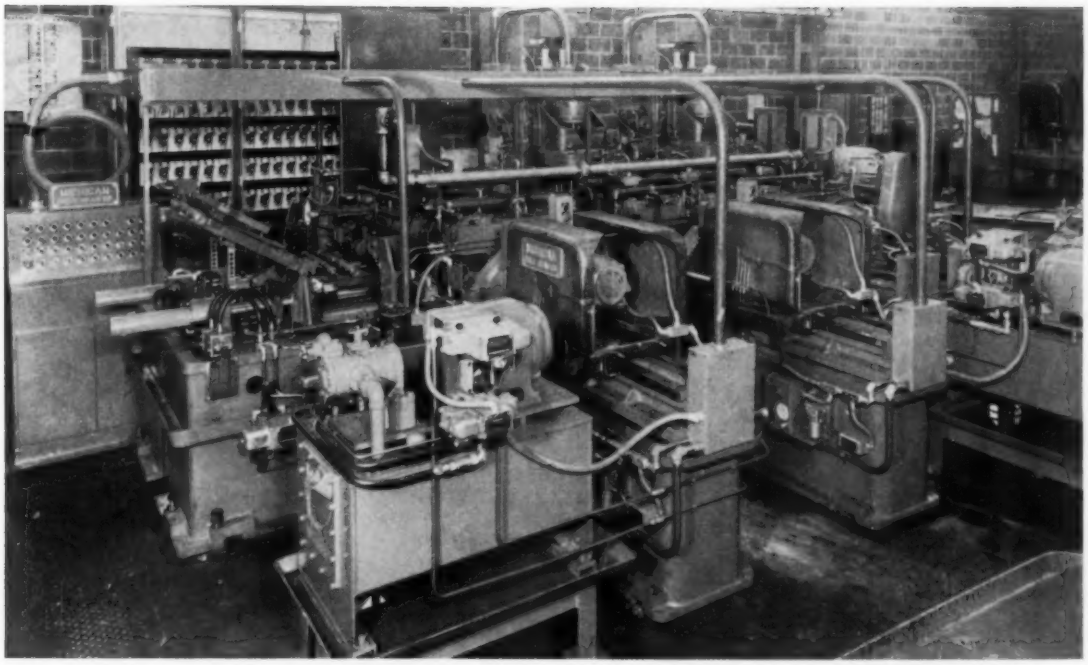


Fig. 1—Photograph taken from the right hand side of a 13-station transfer machine for finishing six holes in a camshaft. Workpieces are loaded into the magazine on left end of the machine and advanced station-by-station to the right.

CAMSHAFT MACHINING ILLUSTRATES

CONTROL OF A TRANSFER MACHINE

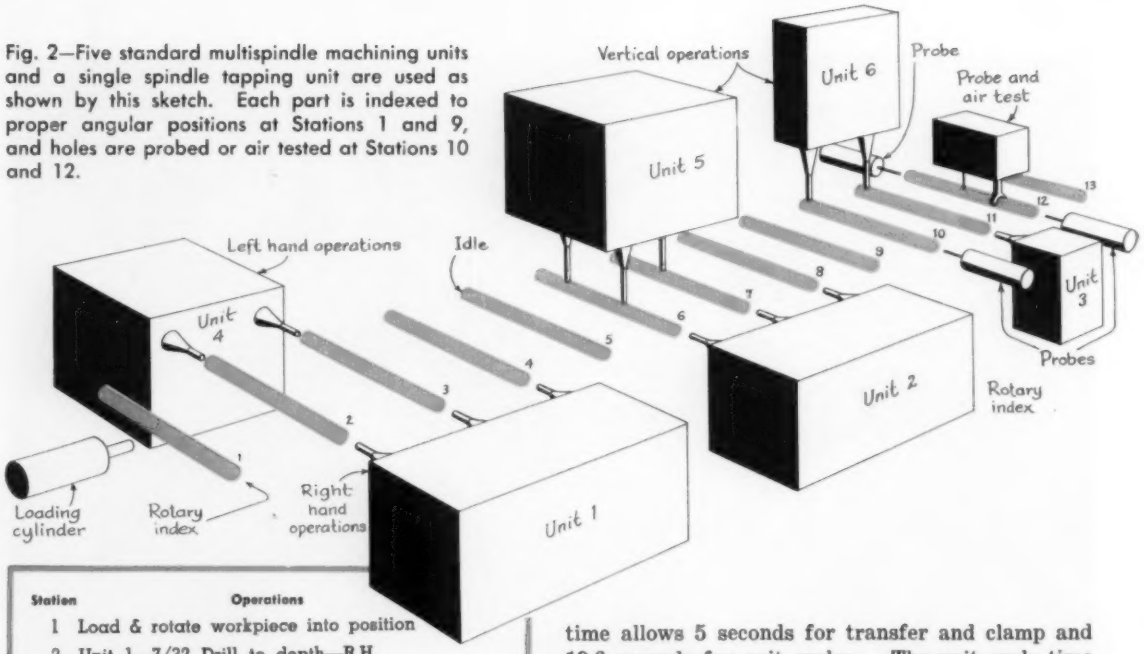
By LEE D. MILLER,
Associate Editor

Transfer machines are well known to many people by name and appearance; but the means by which they accomplish their functions are often obscured by their formidable appearance. Using a relatively small machine as an example, this article outlines the electric, hydraulic and pneumatic components and circuits that make the operation of such a machine possible.

A TRANSFER MACHINE to prepare six holes in a cast iron camshaft is not a large machine compared to many of its brothers in the automobile manufacturing world. However, such a machine is a sizable piece of equipment (66,000 lbs approximate weight, 38½ total horsepower, using about 100 gallons of coolant per minute) and contains most of the types of elements found in even the largest units. The difference, in other words, is mostly in count not in classification of components. Therefore, such a machine can be of interest not only of itself but also because it indicates the types and arrangements of components upon which even larger units depend.

Michigan Drill Head Co. built the 13 station unit, *Fig.* 1, for the Trenton Engine Plant of

Fig. 2—Five standard multispindle machining units and a single spindle tapping unit are used as shown by this sketch. Each part is indexed to proper angular positions at Stations 1 and 9, and holes are probed or air tested at Stations 10 and 12.



Station	Operations
1	Load & rotate workpiece into position
2	Unit 1—7/32 Drill to depth—R.H. Unit 4—9/32 Drill 1/2 depth—L.H.
3	Unit 1—Ream 7/32 hole—R.H. Unit 4—9/32 Drill to depth—L.H.
4	Unit 1—Ream 7/32 hole—R.H.
5	Idle
6	Unit 2—23/64 Drill to depth—R.H. Unit 5—1/8 Drill to depth—VERT. 5/32 Drill 1/2 depth—VERT.
7	Unit 2—Ream 23/64 hole—R.H. Unit 5—5/32 Drill to depth—VERT.
8	Unit 2—Counterbore 23/64 hole—R.H.
9	Rotate workpiece 148°
10	Unit 6—5/32 Drill 1/2 depth—VERT. Probe & blow out—Reamed 23/64 hole—R.H.
11	Unit 3—Tap reamed 23/64 hole—R.H. Unit 6—5/32 Drill to depth—VERT.
12	Probe & blow out—9/32 hole—L.H. Probe & blow out—Reamed 7/32 hole—R.H. Probe—1/8 hole—VERT. Air test—5/32 holes (2)—VERT.
13	—Unload

Chrysler Corp. It drills, reams, counterbores and taps one hole, drills and reams another hole, and drills four other holes in each of the 117 camshafts it processes per hour when running at 80 per cent efficiency. The machine incorporates five standard multispindle units and a single-spindle tapping head, *Fig.* 2. A total of 14 spindles perform machining operations on each workpiece.

Camshafts are loaded into a magazine by the operator, and they are automatically fed, indexed to proper angular orientation, and transferred through the machine at a maximum rate of 146 pieces per hour. Time per machine cycle is 24.6 seconds, so that a part travels from load to unload in about 5 minutes. The machine cycle time allows 5 seconds for transfer and clamp and 19.6 seconds for unit cycles. The unit cycle time requirement is determined by Unit 2 which swings three spindles located at Stations 6, 7 and 8. This unit requires 19.59 seconds to cycle under the following schedule: Rapid advance 1.04 seconds, feed 16.5 seconds, dwell 1.0 second, and rapid return 1.05 seconds. Cycling is provided through step-by-step action of limit switches and relays. No stepping switches are used in the control of this particular machine, and the only timing elements used are time delay relays which provide specified delays after the operation of certain limit switches and control relays.

▶ Operations Performed

Workpieces are handled in this machine by hydraulically operated mechanisms controlled by limit switches, relays and solenoid actuated valves, *Figs.* 3 and 4. In traveling through the machine, each workpiece is automatically moved from the magazine to Station 1 by a loading cylinder. At Station 1, during the unit cycle phase of the machine cycle, a pair of rotary index centers move in, grip the part, rotate the camshaft to proper angular position, and move out. After all unit cycles are completed, transfer centers move in, grip the part, and then the transfer moves the part forward to Station 2. Side clamps grip the part; then vertical clamps also grip the part; the transfer centers move away from the part; and the transfer returns to its initial position. After the unit cycles are completed, the transfer centers move back in, the vertical and side clamps are released and the transfer steps the part forward to the next station. In similar fashion the workpiece is moved through each of the succeeding stations until it is unloaded at Station 13. At Station 9 the part is indexed to a different angular position by index centers which are operated at the same time and in the same manner as those at Station 1.

Six holes are finished in each workpiece. A 7/32-inch hole parallel to the axis of the part and eccentrically located on the right hand or hub end of the camshaft is drilled to depth in Station 2, reamed in Station 3, finish reamed in Station 4, and probed in Station 12. A 23/64-inch hole centered in the same end of the part is drilled to depth in Station 6, reamed in Station 7, counterbored in Station 8, probed in Station 10, and tapped in Station 11. A 9/32-inch hole centered in the left hand end of the part is drilled to half depth in Station 2, drilled to depth in Station 3, and probed in Station 12. A ⅛-inch radial hole is drilled to depth in Station 6 and probed in Station 12. A 5/32-inch radial hole is drilled to half depth in Station 6 and drilled to depth in Station 7; another 5/32-inch radial hole is drilled to half depth in Station 10, drilled to depth in Station 11 and in combination with the other 5/32 hole, air-tested at Station 12.

Four of the holes are individually probed for broken drills or insufficient depth and three are simultaneously blown out. The other two holes intersect each other and are checked by a single air test which blows them out if the intersection is made and both bores are open, but trips a

TABLE 1—Control Actions

Initial Cycle

Steps in the control of the machine can be followed by reference to *Figs.* 3, 4 and 5. Action begins when the operator starts the machine by pressing the *Master Start* button. Through relay *MS*1 this button energizes the starters for all motors driving the hydraulic units and time delay relay *TD*1 which subsequently energizes the starters for all the motors powering the machining spindles except the tapping spindle. With the selector switch on *Auto*, pressing the *Cycle Start* button energizes relay *CRFCLP* and *Sol V* causing the side clamps to move in and make their limit switches and thus relay *CRVCLP* and *Sol W* are energized to clamp the workpieces vertically. After the vertical clamps make their limit switches, relay *CRM* is energized and the machining units and probe slides cycle in and out of the work.

Relay *CRM* energizes *CRICI* and *Sol AD* sending the index centers in at Stations 1 and 9. When these centers are in they make limit switches that energize *CRI* and *Sol AE* causing the index centers to rotate and adjust the angular position of the workpieces in Stations 1 and 9. The rotary indexes make limit switches which de-energize *CRICI* and energize *CRCO* and *Sol AF* to pull the index centers out. When the centers are out they de-energize *CRI*, and energize *CRICB*, *CRRI* and *Sol AG* to return the index, making limit switches and stopping the index.

When relay *CRM* is energized, Units 1, 2, 4, 5 and 6 cycle in the same manner and Unit 1 will be used as an example. *CRM* picks up *CR1F*, *CR1B* and *Sols G* and *H* for rapid advance until *LS1F* drops out *CR1B* for feed advance. Actuation of *LS1F* also picks up *CRPU*. While *CRPU* is picked up, the next cycle will follow the normal cycle sequence. When *LS1R* is made it picks up *TD1D* which drops out *CR1F*, gives a preset dwell, and picks up *CR1B* and *Sol H* for rapid return. *LS1B* drops out *CR1B* and the unit stops in retracted position.

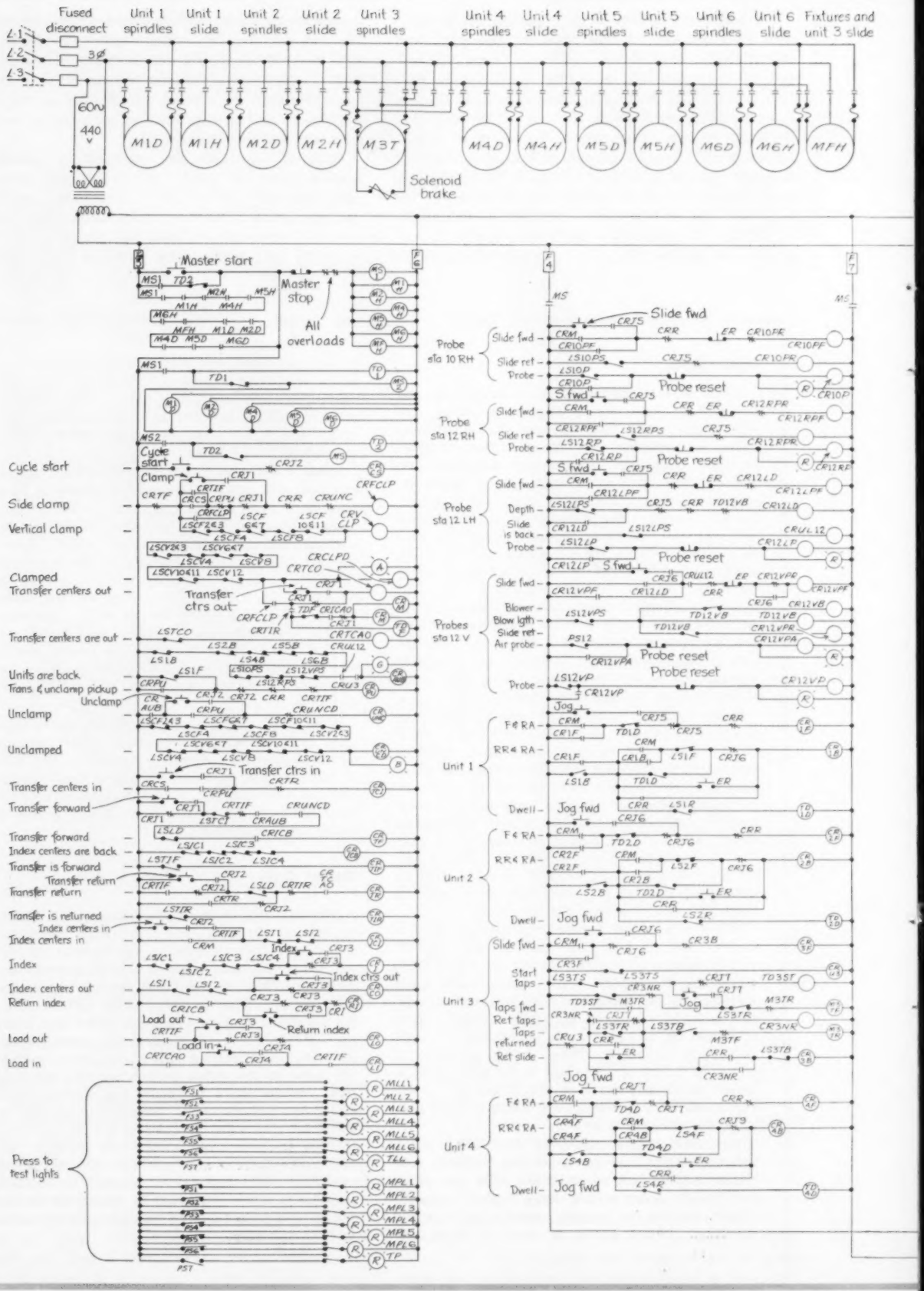
For Unit 3, the tapper at Station 11, *CRM* picks up *CR3F* and *Sol L* sending the slide forward. *LS3TS* is tripped by the slide and picks up *TD3ST*. After a time delay, *TD3ST* picks up *M3TF*, starting the tapping motor in the forward direction. When *LSTR* is made it drops out *M3TF* and picks up *M3TR*, reversing the tap motor, and also energizes *CR3NR* to avoid repeating. When the tap is back *LSTB* is made, picks up *CR3B* and *Sol M*, dropping out *CR3F* and returning the slide. The slide makes *LS3TS* which drops out *CR3B*.

Relay *CRM* also picks up the forward relays and *Sols AK*, *AL* and *AM* on the probes at Station 10, 12 R.H. and 12 L.H. The probes go forward, make their return switches, dropping *Sols AK*, *AL* and *AM*, and the probes return. After the left hand probe in Station 12 has returned, *LS12LPS* picks up *CR12VPF* and *Sol AN* which advances the vertical probe and air test slide at Station 12 and opens the air valve. Advance of the probe makes *LS12VPS* and picks up *CR12VB* and *TD12VB*. After a preset length of blow *TD12VB* drops out *CR12VB* and picks up *CR12VPR* to return the slide, make *LS12VPS*, and stop.

When the machining units, probes, index centers and index are returned, *CRFCLP* and *CRVCLP* are de-energized and *CRUNC* and *Sols Y* and *Z* picked up to release the vertical clamps and the side clamps. When these clamps make their limit switches and stop, the machine is ready for a normal cycle.

Normal Cycle

Pressing the *Cycle Start* button, with *CRPU* picked up from a previous cycle, energizes *CRTCI* and *Sol AA* sending the transfer centers in. When the centers are in *LSTCI* is made and picks up *CRTF* and *Sol AB* sending the transfer forward. The transfer makes *LSTIF*, picking up *CRTIF* which drops out *CRPU* but picks up *CRLO* and *Sol AH*, sending the loading cylinder out, and picks up *CRFCLP*. Cycle is then the same as the initial cycle while side and vertical clamps move in, units and probes cycle, and index centers cycle. Meanwhile, picking up *CRFCLP* also picks up *CRTCO* and *Sol X*, moving the transfer centers out. The transfer centers make *LSTCO* and pick up *CRTCAO* which energizes *CRLI* and *Sol AJ*, moving the loading cylinder in and making *LSLD*. Relay *CRTR* and *Sol AC* are picked up, the transfer returns, makes *LSTIR*, and stops.


Fused disconnect
Unit 1 spindles
Unit 1 slide
Unit 2 spindles
Unit 2 slide
Unit 3 spindles
Unit 4 spindles
Unit 4 slide
Unit 5 spindles
Unit 5 slide
Unit 6 spindles
Unit 6 slide
Fixtures and unit 3 slide
L1
L2
L3
3Ø
60~
440 V
M1D
M1H
M2D
M2H
M3T
M4D
M4H
M5D
M5H
M6D
M6H
MFH
Solenoid brake
Master start
Master stop
All overloads
Cycle start
Clamp
Side clamp
Vertical clamp
Clamped
Transfer centers out
Transfer ctrs out
Transfer centers are out
Units are back
Trans. & unclamp pickup
Unclamp
Unclamped
Transfer ctrs in
Transfer centers in
Transfer forward
Transfer forward
Index centers are back
Transfer is forward
Transfer return
Transfer return
Transfer is returned
Index centers in
Index
Index centers out
Return index
Load out
Load out
Load in
Load in
Press to test lights
Slide fwd
Probe reset
Jog
Jog fwd
Probe sta 10 RH
Probe sta 12 RH
Probe sta 12 LH
Probes sta 12 V
Unit 1
Unit 2
Unit 3
Unit 4

pressure switch, *PS*12 in *Figs.* 3 and 5, if they do not intersect or are not open. The hole which is tapped in Station 11 is probed in Station 10 to avoid trying to tap a hole with insufficient clear depth. All the other probes and the air test are located at Station 12. The probe and blow-out noses are carried in and out of the work by hydraulically actuated slides, *Fig.* 4. If a probe meets resistance, it closes a limit switch that actuates the emergency return of all probe slides and machining units and turns on a light indicating which probe was tripped. The operator must press the reset button for that probe before cycling can be resumed.

Automatic lubrication systems are provided for elements of the machine. Pressure and float switches are provided for each system, so that warning lights indicate whenever lubricant is low or pressure is low in any of these systems. The lights used are press-to-test lights which can be checked by the operator to ensure that a warning light is not inoperative.

▶ Control Actions

Provision is made in the control arrangements for two types of automatic cycles, an initial cycle and a normal cycle. An initial cycle sequence without station-to-station transfer is used so that operations are not missed on any work in the machine when starting up after a shutdown. TABLE 1 and *Figs.* 3, 4 and 5 describe the operation of the machine in both initial and normal cycles.

After the operator presses the *Master Start* button, *Fig.* 3, and motors are started on the hydraulic and machining units, the operator begins the initial cycle by pressing the *Cycle Start* button. Side clamps grip the workpieces in the machining stations, then vertical clamps grip the parts. The

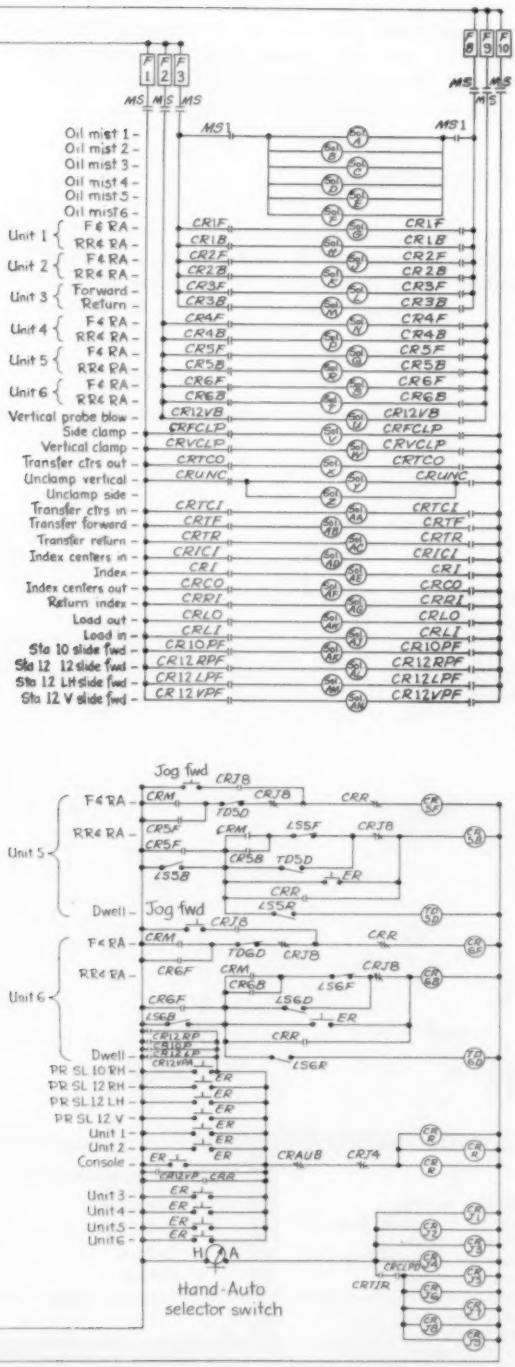


Fig. 3—Diagram of the electrical control circuits for the camshaft machine shows how limit switches and relays are connected to carry out automatic and hand cycles. Two types of automatic cycles are provided, an initial cycle in which no station-to-station transfer occurs and a normal cycle including transfer.

Key to Electrical Diagram

CR***—Control relay
ER—Emergency return
F & RA—Feed & Rapid advance
FS*—Float switch
LS***—Limit switch
MLL—Mist lubricant low
MPL—Mist pressure low
PR SL—Probe slide
PS*—Pressure switch
RR & RA—Rapid return & Rapid advance
TLL—Trabon lub low
TP—Trabon plugged
(**) —Coils in solenoids, relays

Summary of Components

60 Control relays
7 Float switches
56 Limit switches
42 Manual switches
12 Motors with starters
8 Pressure switches
21 Push to test lights
9 Timing relays
1 Transformer

machining units and probe slides cycle, and rotary indexing is performed at Stations 1 and 9. When all units get back, the vertical and side clamps are released and the machine is ready for a normal cycle.

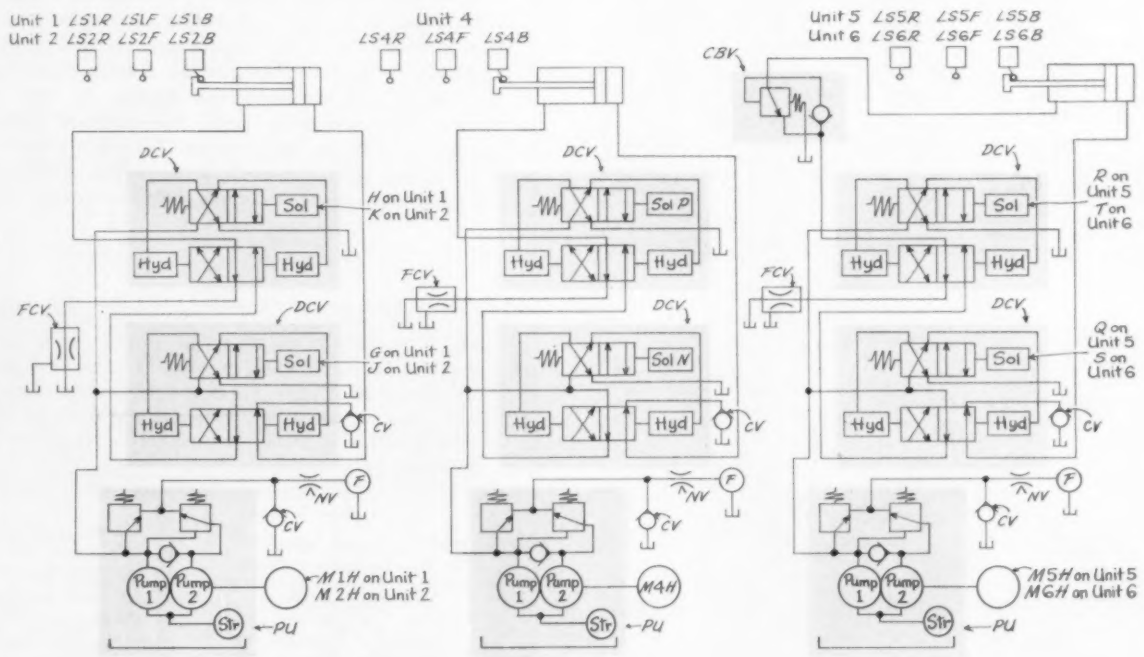
When the operator presses the *Cycle Start* button for a normal cycle, transfer centers move in to grip the workpieces, and the transfer mechanism moves forward to advance the workpieces one station. A loading cylinder feeds one part from the magazine to Station 1; the side clamps and then the vertical clamps grip the parts in Stations 2, 3, 4, 6, 7, 8, 10, 11 and 12; and the transfer centers move out. The transfer and loading cylinders return and the machining units, probes and indexing mechanisms cycle. At the completion of these cycles the side and vertical clamps are released and the machine is ready for another normal cycle.

If the operator turns the selector switch from *Auto* to *Hand,* hand buttons for manually operating the machine will be made operative. These buttons control transfer centers in and out, transfer forward and return, loading cylinder in and out, index centers in and out, index forward and return, and advance and return of probes and machining units.

Pressing any *Emergency Return* button or tripping any of the probe switches while running on automatic will cause all machining units and probes to return. The operator will have to reset a probe circuit which has been tripped and the machine must then go through an initial cycle before normal cycles are resumed. When the machine is on *Hand,* pressing an *Emergency Return* button on a unit will return that unit only; the *Emergency Return* button on the console is inoperative while running on *Hand* setting.

▶ Control Features

Cycles are not timed by a central program device; instead, step-by-step action is used in which succeeding steps must wait for the completion of certain other steps. This is a typical application



Key to Hydraulic Diagram

CBV—Counter balance valve
CV—Check valve
DCV—Directional control valve
DV—Deceleration valve
F—Filter
FCV—Flow control valve
NV—Needle valve

MFH, M1H, M2H,
M4H, M5H, M6H—Electric motors driving hydraulic pumps
PG—Pressure gage
PRV—Pressure reducing valve
PU—Pump unit with sump & strainer
SV—Sequence and check valve
V—Shutoff valve

Summary of Components

6 Pump units
30 Cylinders
59 Valves
6 Filters
2 Pressure gages

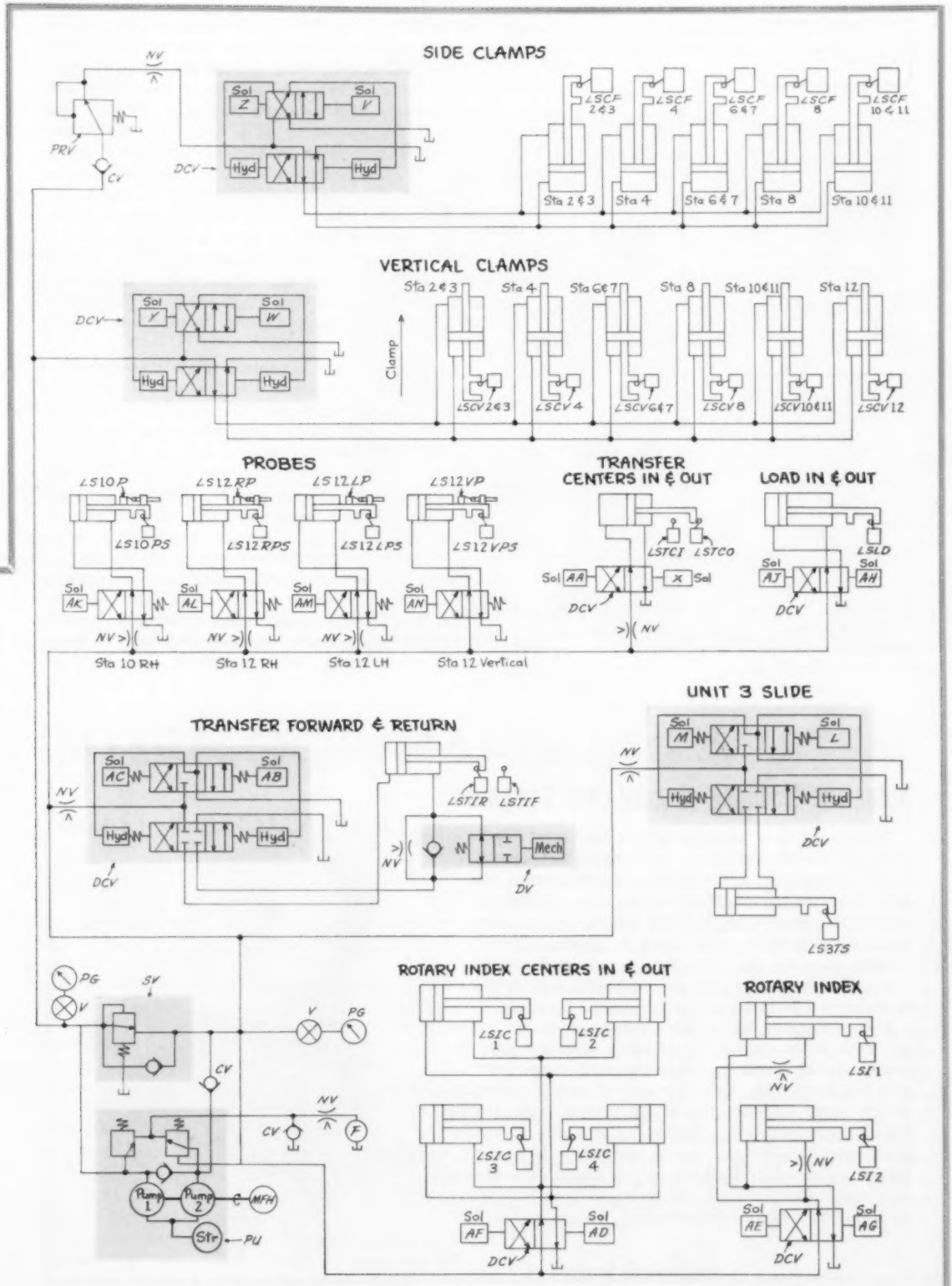


Fig. 4—These hydraulic diagrams indicate the means by which machining units, probes, clamps, and index and transfer centers are operated. Associated limit switches and solenoid valve operators are shown.

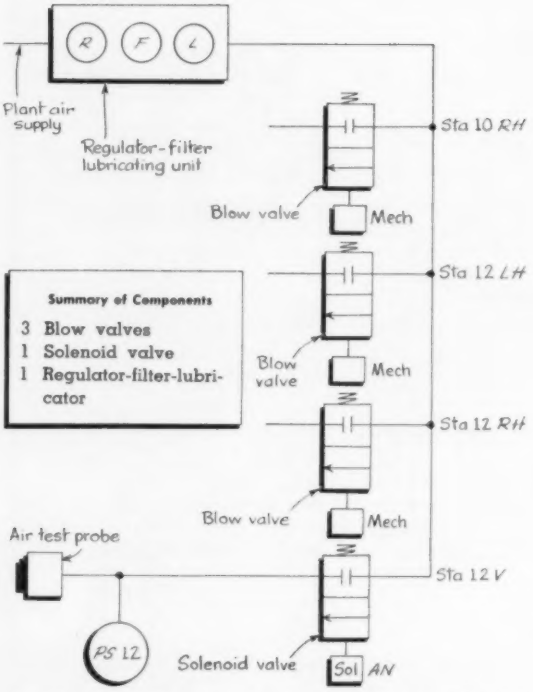


Fig. 5—Pneumatic circuit for the 13-station transfer machine illustrates the means controlling air for blowing out three holes as they are probed and an air test for two intersecting holes.

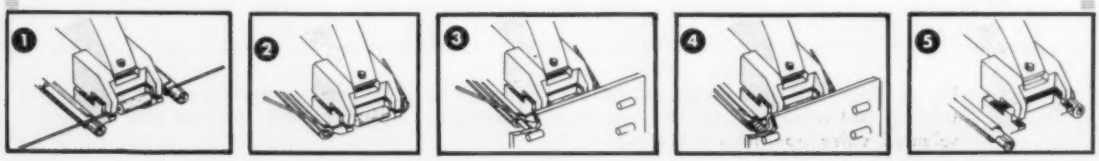
of limit switch control and insures that actions do not occur out of sequence and are fully completed before succeeding actions are initiated. Relative timing of machine actions is thus inherently maintained even though absolute timing may change. In equipment such as this transfer machine where actions of various machine elements can interfere with each other, this maintenance of relative timing between motions is highly important. The absolute time required for a hydraulically actuated slide to move a specified distance will vary under the influence of many factors such as valve clogging, variation in way friction, etc. If an absolute time program were followed in initiating interfering actions, trouble would soon occur.

In these circuits, a control relay is energized or de-energized for each successive control step. The place which the machine has reached in its cycle is thus marked by the relays that are energized. Use of relays in this manner can mean that currents to energize solenoid valves pass only through relay contacts in the control circuits and not through the limit switches which initiate the actions. Actuation of a single multicontact relay can also be conveniently used to simultaneously close contacts to several solenoids or other relays. Provision of relays in combination with the solenoids that operate valves in the system also readily permits the automatic disconnecting of both leads to a solenoid when it is de-energized.

Automatic Mounting of Axial-Lead Components

Illustrated is a machine which has been developed by Keller Tool Div. of Gardner-Denver Co. to simultaneously make wire-wrap connections for both leads of an axial-lead component. Resistors, capacitors, diodes, or straight wires can be automatically fed from a reel pack as shown. Circuit boards carrying the terminals on which the components are to be mounted are positioned in the machine either manually or by special fixtures.

Two laterally adjustable wrapping tools are mounted with spacing to accommodate the component being handled. Tape-mounted components are fed from the reel to a set of gripper jaws which move one component at a time from the tape to the wrapping position. The leads of the component are placed in the wrapping bits and folded to an axial position in the bits; then the bits are positioned over the terminals and rotated to form the wrapped connections.



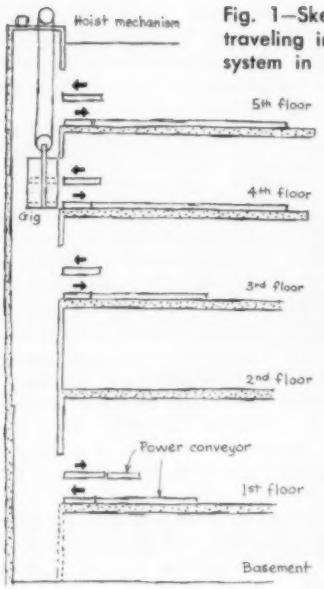


Fig. 1—Sketch illustrates eight horizontal chain conveyor systems and a gig traveling in a vertical shaft which provide an automated interfloor handling system in a multistory industrial plant.

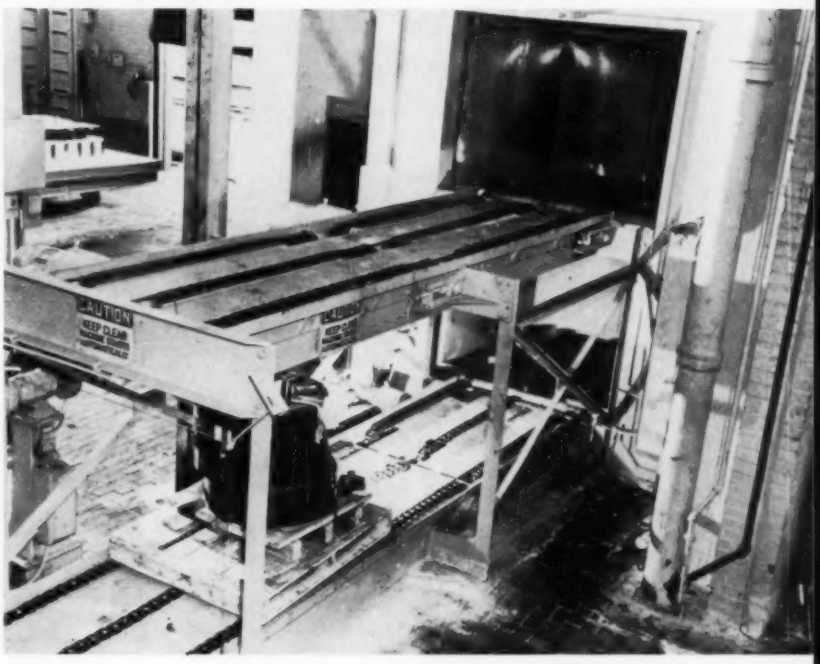


Fig. 2—At the first-floor loading point shown, loads move into the gig on the lower level conveyor system and out of the gig on the upper level. Movements of the gig and the conveyors are automatically interlocked.

INTERFLOOR HANDLING SYSTEM

CYCLES AUTOMATICALLY

THERE'S LITTLE chance of a 6000-lb load of transformer components getting misdirected en route between floors on a new automatic interfloor handling system recently installed at General Electric's Specialty Transformer Dept. Designed, built and installed by Gifford-Wood Co., the system automates the transfer of raw materials from the building's first-floor receiving area to production lines on three upper floors. It is also used to move scrap and packaged materials back to the first floor, and transfer loads between the upper floors.

The complete system is centered around an elevator *Fig.* 1. Two horizontal conveyor systems, one for loading and one for unloading, are installed at each of the floors served (first, third, fourth and fifth) and are interlocked with the elevator. This elevator, or gig, contains two levels of chain conveyors that work in conjunction with the two levels of floor conveyors, *Fig.* 2.

A "memory panel", *Fig.* 3, tells the operator by means of signal lights where a load is coming from and where it is to go. Since four floors, nine different conveyor elements and 12 different transfer routings are involved, this panel is very helpful to the single operator who controls the entire system from the first floor. When a worker on one of the upper floors has a load to transfer, he presses a button on the control panel located on his floor. This flashes a light on the first-floor main panel and tells the handling system operator the destination. As soon as the load moves into the gig, this destination is flashed on another light on the first-floor panel. Colored lights and lettering on the main panel indicate to the operator the loading and delivery points for each load.

▶ Typical Operations

Here are the main steps in moving a load from the first floor to any of the upper floors:

1. The first-floor operator sets the selector switch on the desired operating cycle. There are five types

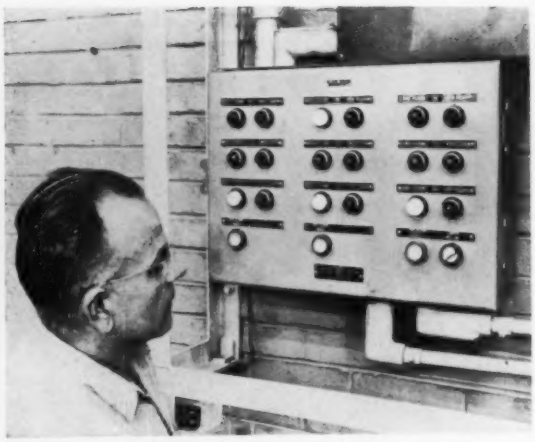


Fig. 3—Lights on this first-floor display panel tell the operator where loads are to be picked up and indicate their destinations. By means of a nearby control panel he sets the destinations and selects the cycle of automatic movements desired.

of cycles provided: Cycle No. 1 is *Full Automatic*, for moving a series of pallets from the same loading point to the same delivery point. In this case the operator need make only an initial cycle setting on the system's main control panel. Cycle No. 2, *Up Only*, delivers a single load to a floor. This is used when each of a series of loads is to be delivered to a different floor. In such cases, the operator cycles each load from the panel. Cycle No. 3 is *Up-Down*, which automatically carries a pallet to a specified floor and brings down another pallet from the same floor. Cycle No. 4, *Down Only*, sends the empty gig up to a floor, where it picks up a load and returns. Cycle No. 5 is for manual control of the gig, and is used for service and maintenance operations.

2. The operator then sets a switch on the main operating panel for the desired destination of the load.

3. He moves the load by fork truck to the first floor conveyor, places it on the conveyor, and then backs the truck away. A photoelectric switch starts the horizontal conveyor after the truck backs away.

4. As the load approaches the doors of the gig shaft, it contacts a limit switch which stops the horizontal conveyor and actuates the downward motion of the gig. (When not in use, the gig automatically moves to a neutral position at the second floor level. This floor is not served by the system.)

5. As the gig approaches the first floor the movement of the gig opens the shaft doors; next a switch in the vertical shaft cuts off the main gig motor and starts the leveling motor.

6. As the gig levels into receiving position, it contacts a switch which shuts off the leveling motor and starts the horizontal conveyor and the conveyor inside the gig. The pallet moves into the gig and a switch at the rear of the gig stops both the feed conveyor and the floor conveyor in the gig. This switch also starts the upward motion of the gig and closes the gig doors. The gig moves upward at a speed of 60 fpm.

7. At the receiving floor a solenoid-operated door opening device on the gig is actuated by a switch in the hatchway; shaft doors are contacted by the ascending gig; and the doors are opened. The gig is leveled and then contacts a switch which stops the leveling motor and starts the transfer conveyor inside the gig and a short receiving conveyor on the floor outside.

8. After a pallet moves from the gig to the short receiving conveyor, it strikes another switch which starts a long conveyor beyond the short unit and stops the conveyor inside the gig. This also starts the gig moving downward and closes the doors.

9. When the pallet passes completely onto the long conveyor, it releases a switch which stops this unit. As succeeding loads are received from the gig, this long conveyor moves each load forward one pallet length, so that the conveyor can hold several loads before pickup is necessary. When the first load reaches the end of the conveyor, it contacts a switch that signals the operator on the first floor that no further loads should be sent to this station until the conveyor has been unloaded. It also electrically prevents the system from operating to that floor until pallets are removed.

When pallets are to be removed in a downward direction, or from one upper floor to another, the load is placed on the upper conveyor of that floor. The operator then notifies the main control panel by means of pushbuttons that he has a load to be transferred, and where it is to go. Transfer sequence is approximately the same moving downward, with conveyors, doors, and control features interlocked throughout the entire sequence.

▶ System Features

Oversize pallet detectors are installed around each feed conveyor, to prevent delivery into the gig of overload or badly stacked pallets. These detectors use a wire that travels up from one side, over the top and down to the other side of the conveyor. If any pallets are loaded more than 8 inches in excess of the established width or height (40 by 46 inches), they will strike this wire and trip a switch that stops the entire conveyor system.

A photoelectric eye at the first floor conveyor stops and starts this conveyor for loading and unloading operations. When a fork truck approaches with a load, the truck breaks a light beam, which stops the moving conveyor. After positioning the load the truck backs off from the conveyor. This restores the beam, and the conveyor moves the load into the gig.

On the upper floors a series of signal lights and alarm bells notify the truck operator on each floor when a load is approaching for pickup. These alarms are set off by a switch in the gig shaft that is contacted by the approaching gig.

Safe-run switches and main power disconnect switches are installed on each floor to cut off the entire system in case of accident, or for maintenance. Slack cable limit switches protect the gig against cable accidents.

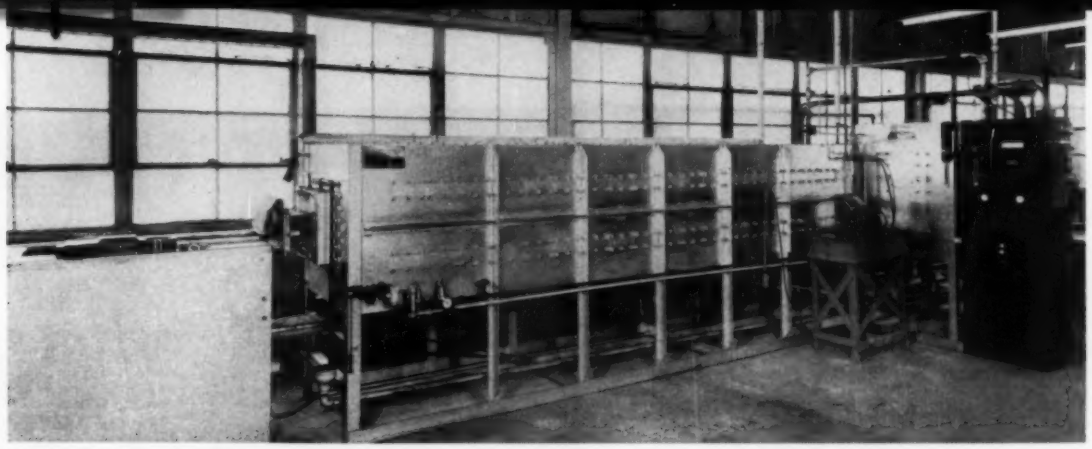


Fig. 1—Reed Rolled Thread Co. heat-treating installation. In addition to production advantages, the photo shows the distinct improvement in plant conditions with automated heat treating over the older hand methods.

INTEGRATE HEAT TREATING THROUGH AUTOMATION

Automation developments prevail in all types of manufacturing operations. Here the authors reveal techniques that accomplish the automation of heat-treating operations.

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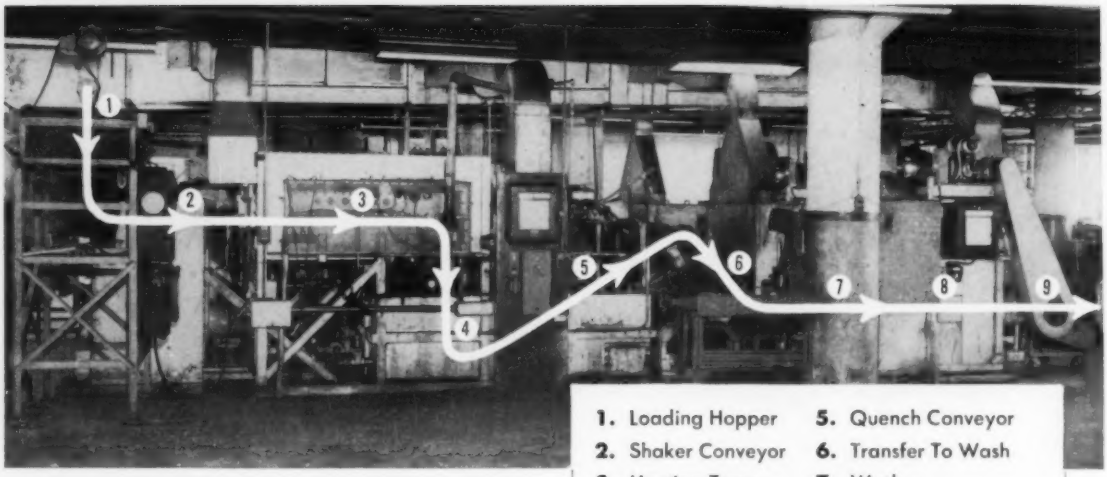
BY ANTICIPATING the increased production demands required by our dynamic economy, heat-treat equipment manufacturers now have equipment available that adapts readily to automatic heat treating. This equipment includes improved atmospheric control units, more versatile furnaces, more accurate controls, better drying equipment, and a vast array of conveyor belts, vibrators, tram rails, and similar components that can be combined into automatic systems to meet these exacting demands.

Many of the more progressive manufacturers have proved that heat-treat automation can make a better product at less cost in less time. These manufacturers were quick to draw from the reservoir of knowledge and experience offered by heat-treat equipment manufacturers and the new and improved process equipment now available.

As is too often the case, some companies and manufacturers are not aware of the potential that automated methods offer them through a more up-to-date and efficient heat-treat program. Compare the labor and time consuming method of pack hardening high carbon, high chrome, roll thread dies with the highly efficient and much more satisfactory results obtained by a manufacturer utilizing modern methods and equipment.

To pack dies prior to the advent of automation, barrels of iron chips were brought to the hardening room and then costly and heavy alloy containers were readied by placing a layer of chips in the bottom. Paper wrapped dies were then placed in the containers and completely surrounded and covered with more chips. The containers were covered and sealed with cement—another manual operation—then they had to be moved to a box furnace (not equipped with controlled atmosphere) and heated to above 1800 F. Long tongs were used to place the die containers into the furnace after a large door was opened. After the parts were heated, they were removed, again by the hand-tong method, the containers opened, dies extracted individually and placed on racks to cool. All this was a two-man operation. The dies were



1. Loading Hopper
2. Shaker Conveyor
3. Heating Zone
4. Quench
5. Quench Conveyor
6. Transfer To Wash
7. Wash
8. Furnace (Tempering)
9. Discharge

Fig. 2—Automated heat-treating installation. Parts are loaded at the left, point 1, are moved by shaker conveyor, point 2, to heating zone, point 3. Quench and quench conveyor are points 4 and 5. Point 6 is a transfer to wash station and point 7, behind the pillar, is the wash. Tempering furnace is point 8. Parts are discharged at point 9.

then rolled in front of a fan to speed cooling, tested for hardness, and put in a tempering furnace. The sand blasting required for surface conditioning was undesirable, especially on fine thread dies.

However, after automation, utilizing modern heat-treating equipment, *Fig.* 1, this same work is accomplished in an electrically heated muffle conveyor furnace with protective atmosphere of the Ampro process. The dies, without covering, are placed on a conveyor belt in front of the furnace. Then they move automatically through the furnace at proper heat, and are conveyed to a cooling section where they are atmosphere-quenched to proper hardness. Further atmosphere cooling prevents oxidation of this work. The dies are then removed and tested for hardness and placed in a draw furnace for tempering. Results of heat treating with this method are far superior to the old method.

By combining several functions in one unit and selecting the allied components that make it an automatic operation, this simple example of hardening utilizing the latest in heat-treating equipment demonstrates how the heat-treat cycle can be incorporated with other manufacturing processes for more complete automation.

Another system in which a manufacturer has coordinated the heat-treating cycle into his overall operation to obtain a superior product more economically is shown in *Fig.* 2. The production cycle brings the parts to the front of the furnace where automatic equipment takes over to move them through the furnace at a controlled rate under proper atmosphere and temperature, discharges them into quench from which they are removed by conveyor belt, and then on to subsequent processes.

Heat-treating of materials involves more than the application of heat. Controlled heat-treating may be subdivided into three categories: 1. Temperature control. 2. Atmosphere control. 3. Materials handling.

Temperature may be controlled over a wide range by numerous models of temperature control instruments and accessories readily available from the various manufacturers of this type of equipment. Properly applied, these instruments are capable of automatically controlling the temperature of the heat treat. Once established, the atmosphere of a heat-treating furnace may also be automatically controlled. In most instances, generating equipment will afford truly reproducible results providing proper procedure is adhered to.

By only briefly mentioning temperature and atmosphere controls, we do not wish to minimize their importance. But emphasis is put on the third category, materials handling, because so many manufacturers are not aware that the heat-treat engineer has so many means at his disposal to customize and automate the manufacturer's processes.

This third category pertains to the preparing, loading, feeding, conveying, discharging, and handling of the heat-treat items. Since these operations cover such a tremendous range of applications, each application requires individual consideration. At the present time some heat-treating procedures cannot be mechanized completely, but many phases can be improved by some mechanization. These semiautomated applications provide valuable experience and data which can be applied at a later date should more complete mechanization become feasible.

Before discussing the various materials handling methods associated with heat treating, a review of existing electric heat-treating furnaces and arrangements is appropriate, *Fig.* 3. The box furnace is basic for practically all types of heat-treating—for high or low temperature operations with open brickwork—and is usually used with protective atmospheres. Atmosphere cooling provides for cooling under protection of controlled atmosphere. A muffle furnace eliminates the contaminating influence of open brickwork.

Atmosphere quench is forced circulation of protective atmosphere which speeds quenching. Oil or water quench under protective atmosphere affords bright hardening or carburizing. Low or high temperature furnaces utilize conveyor belts which may be driven at varying speeds, continuously or in automatic intermittent intervals. The conveyor belt may be replaced by an automatic latch mechanism designed to convey the work through varying distances throughout the furnace at equal or predetermined intervals.

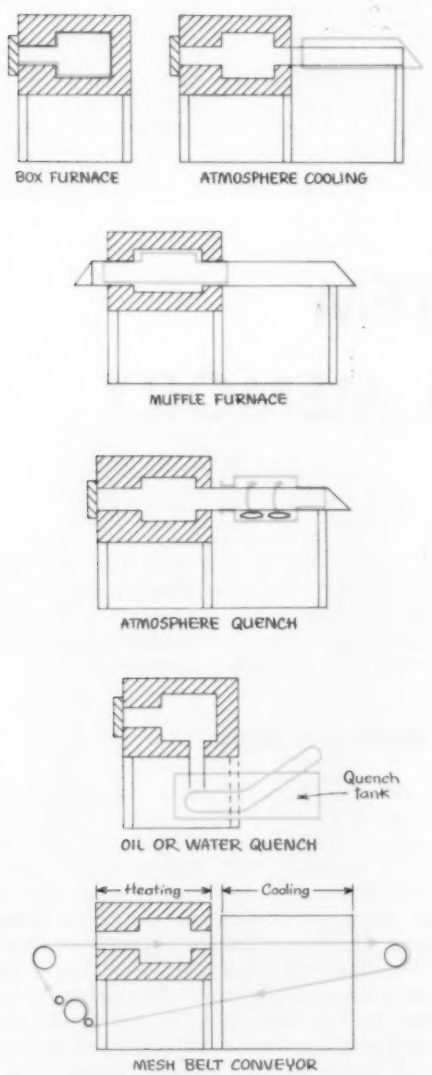


Fig. 3—Various electric heat-treating furnaces and arrangements common to the industry.

There are numerous means available for conveying parts through a furnace. These include roller tray and roller rails (which use pushing mechanisms to impart motion); and roller hearth, made up of a series of driven rolls. A reciprocating or shaker hearth may be used to convey small parts through the heat when rapid transfer from heat to oil or water quench is required. Flight conveyors can be installed in quench tanks to remove quenched parts.

Reproducible results on the work can be obtained only when conditions remain constant from work cycle to work cycle. Among other things, this means providing the quench medium with automatic temperature control. Proper quench control is just as vital to automatic installation as it is to the heat treater doing hand quenching from a box furnace.

We have mentioned just a few of the numerous combinations or arrangements possible with a basic furnace and components. Designing the arrangement which best suits a particular application depends upon the following factors: 1. The required process for the particular heat-treat cycle. 2. Size of pieces and production desired. 3. Results desired. 4. Process before and after heat-treating.

In most cases, various heat-treating cycles can be satisfied merely by readjusting temperature, speed of conveyance, and atmosphere controls without any modification of the heat-treating equipment. Too wide a range of heat-treating with one piece of equipment may sacrifice simplicity and lower the efficiency of the equipment.

Consideration should also be given to the processes prior to and following heat-treating as these factors affect the design of the original equipment. It is important to determine the best available means to interpose between processes to form a chain of production, and this depends upon how the work can be handled and what the product is that is being processed. Every heat-treating process therefore should be reviewed with the thought of modifying existing equipment if possible, and in so doing, to make a definite step toward automatic heat-treating. Modifications are not always expensive and a simple rearrangement of present equipment which co-ordinates the heat-treating procedures with other processes might be all that's required.

Potential of automated heat-treating can be realized only when manufacturers using heat-treating are made aware of the equipment and methods now available. They in turn must make known their needs and work with the engineers who are designing today's industrial equipment. Users can then realize the increased production, better products, and competitive advantages that automating heat-treating processes can bring.

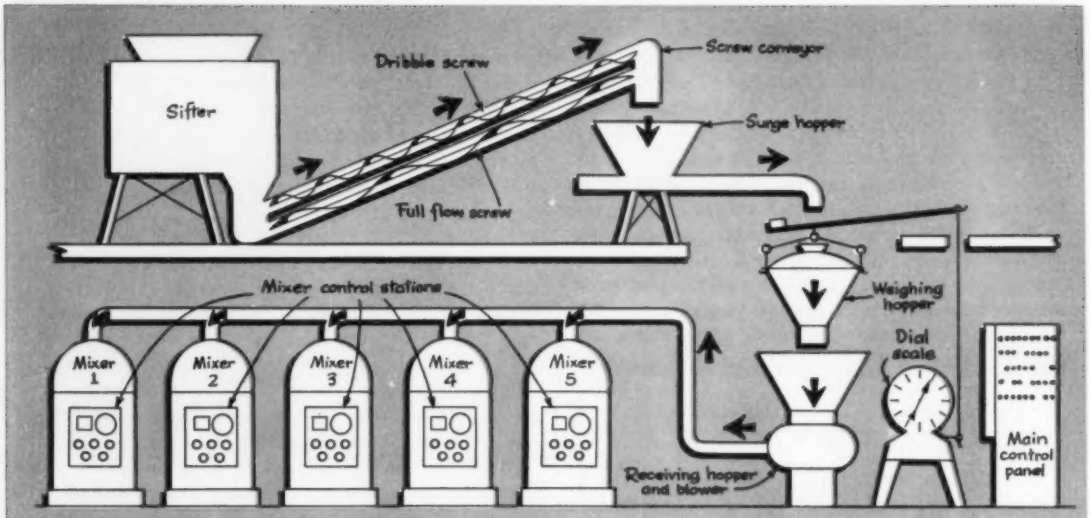


Fig. 1—Schematic diagram of flour processing system which utilizes one scale hopper to service five dough mixers. Control stations at the individual mixers transmit batch requests to main control panel which records sequence of requests and amounts requested and actuates system accordingly.

WEIGHING SYSTEM HAS A MEMORY

MEMORY is an attribute which is sometimes ascribed to a system in which a time delay is involved—it is said the system "remembers" instructions or settings for the duration of the time delay. A more sophisticated usage of the word would require the information to be available "on call," or after an indefinite rather than a fixed time delay period. Such an arrangement is embodied in the control setup for an automatic flour processing system, *Fig.* 1, installed in an eastern bakery by Richardson Scale Co. Heart of the system is the Select-O-Weigh memory control panel, *Fig.* 2, which, together with five individual control stations—one at each mixer—takes care of the automatic feeding of flour from the sifter through to the individual mixers.

To request a weighing, an operator first sets a weight selector dial on the control panel, *Fig.* 3, associated with a particular mixer for the amount of ingredient his formula requires. He then pushes a *Batch Request* button which transmits his request electrically to the main control panel. A *Mixer Acknowledged* light in turn flashes on the operator's panel and remains lighted until the weighing has been delivered to the mixer. This sequence is followed for all mixers in the system. The main panel retains information from all mixer panels, including specified weights and sequence of requests, until the weighing has cleared through the automatic scale and delivery system.

Operational Details

On command from the main control panel, flour is delivered from the sifter to the surge hopper through an inclined screw conveyor. The surge hopper is equipped with high and low level bin controls. These prevent overfilling of the surge hopper and also protect against inaccuracies of weighing due to inadequate supplies of flour.

To transfer flour from the surge hopper to the scale weighing hopper, two feeding screws are used —a full flow screw and a dribble screw. Operation of these two screws is controlled by an adjustable dribble cutoff switch mounted on the dial scale. This is an electronic switch adjustable for up to 20 per cent of the total weighing load. The dribble feed screw will operate only when the flour is above the level of the low level switch

in the surge hopper. The full flow screw does not have any effect on the accuracy of weighing. For instance, it may deposit 80 per cent of the required amount in the weighing hopper, but if the level of flour in the surge hopper falls below the low level switch, the full flow screw will stop and both screws will remain idle until the supply of flour is replenished. Thereupon the dribble screw will operate and complete the weighing within the prescribed accuracy. This is usually within one graduation on the dial scale, or one tenth of one per cent.

When a weighing has been completed it is discharged into the receiving hopper. A blower in this unit is started and runs for a few seconds before the receiving hopper feeds the flour into the blower system.

The main control panel insures that the proper valve is opened, that the diverter in the pneumatic system is positioned to direct flour to the right mixer and that all other valves and diverters are closed before the blower in the receiving hopper can start. When this blower comes up to speed the receiving hopper opens and the flour flows directly to the mixer. This action continues until the level of flour in the lower hopper reaches a low level control switch. Then a timer (which is adjustable) continues the operation for the amount of time necessary to clear the flour from the lower hopper to the farthest mixer. At the end of this preset time, the discharge feeder in the lower hopper is stopped but the blower continues for another short interval in order to thoroughly purge the line and leave it empty for the next mixer charge.

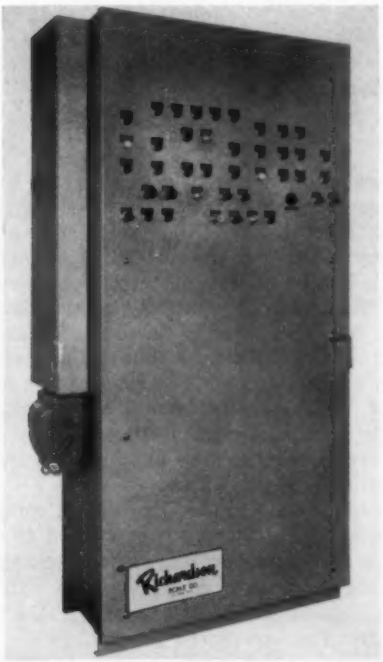


Fig. 2—Main control panel located adjacent to the dial scale. This panel contains locked controls capable of overriding normal station controls in an emergency. Signal lights indicate operating condition of the system.

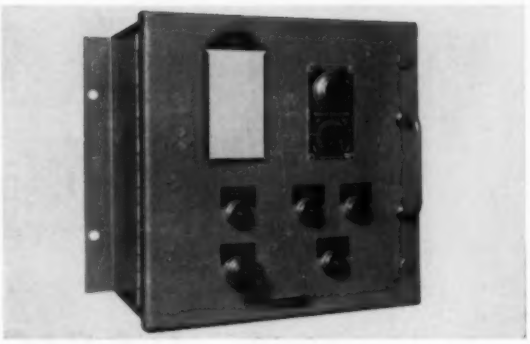
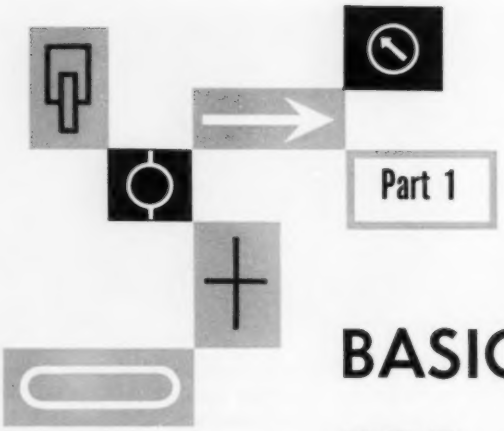


Fig. 3—Station control panel installed on each mixer. Mixer operator sets a weight selector dial for the desired weight of flour and transmits his request to the main control panel by pressing a *"Batch Request"* button.

After it is charged, the mixer operates for the required amount of time. When the batch has been properly mixed, the operator must open the mixer door and reclose it before he can request the next charge. In order to avoid loss of time when several mixer operators are in need of additional flour, the scale will proceed immediately to make up the next batch for the succeeding mixer. This new batch, however, cannot be discharged until the line has been completely purged of all flour going to the mixer previously requesting, so that there will be no overlapping or mixing of batches.

The main control panel installed adjacent to the dial scale indicates the routing and progress of flour from surge bin to mixers. This panel does not require an operator, but contains interlocks and signal lamps. It is also fitted with locked controls so that if any operator should inadvertently call for the wrong amount, correction is possible by manual operation from the main control panel. Interlocks are provided against overweight and underweight, against improper empty balance or tare (in the event of flour adhering to the weigh hopper) and in case of "dial override" which might occur if an amount greater than the capacity of the scale is requested. All of these conditions are safeguarded against with alarm signals, and the system is arranged so that overweights may be recirculated to avoid spoiling batches. Underweight can be corrected to the required amount by manual pushbutton at the main control panel only. Emergency manual operation of the mixer, blower, scale feeders etc. may also be effected through special locked controls on the main panel which normally are not utilized.

First installation of the system was for co-ordinating delivery of flour weighings to a series of dough mixers. Richardson reports that the same type of system could be installed for a proportioning system involving several ingredients.



BASIC PNEUMATICS FOR AUTOMATION

ACTUATION AND CONTROL OF SIMPLE MOTION

Although pneumatic systems are not as free as the air we breathe, use of air as a pressure and control medium is often dictated by economic considerations. This series of articles is designed to assist in determining the advisability of using pneumatics in automation installations and suggest how to do so.

By H. L. STEWART and J. M. MORITZ, Logansport, Ind.

THIS SERIES of articles will describe basic pneumatic devices and systems, and show how the precise and efficient operation of automation equipment can be accomplished through the use of pneumatic power. Since compressed air is available throughout the departments of many plants, its utilization in the broad technology of automation is "a natural."

Advantages of using compressed air as a means of actuation are several. First, as mentioned, it is readily available. This means that one can design a machine or fixture using compressed air, yet not be required to go to the expense of providing a source of power such as would be the case in a hydraulically operated machine. However, if so many compressed air devices are placed in a plant that the compressor capacity is inadequate, then it will be necessary to lay out a considerable sum for added capacity.

Relatively speaking compressed air is a clean medium. Instead of requiring exhaust lines as do oil and water systems, the exhaust air can be released to atmosphere. Usually, exhaust air is piped away from a device only when there are many devices in a small space and the noise of exhausting air is objected to by the workers. Even in these instances, small inexpensive exhaust mufflers may be used to reduce the noise. Also, exhaust air can be used to operate ejector devices.

Pipe lines are comparatively small. Since this medium is seldom used at pressures in excess of 150 psi, and a sufficient volume of air can pass through a small orifice, the piping can be small in diameter which results in less cost. Small pipe lines are more easily installed since they can be easily formed and flared to meet the requirements. Pipe fittings are less expensive also.

From the standpoint of fire hazard, compressed air is safe. Air systems are employed to advantage in such "hot spots" as furnaces, rolling mills, and welding installations. It is also safe when used in explosive atmospheres since there need be no electrical equipment present.

Components which make up an air circuit are relatively simple in design and low in cost as compared with other motivating means. For example, for less than 50 dollars one can purchase a valve and cylinder that will serve for a consider-

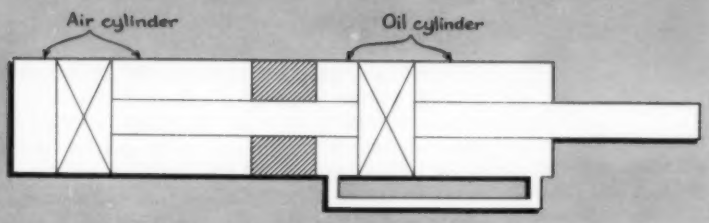


Fig. 1—Closed circuit hydraulic cylinder which provides the smooth, even feed of a hydraulic cylinder but is powered pneumatically.

able period of time with very little maintenance.

Much flexibility is afforded by the use of compressed air. It will not only cause an air cylinder to do work, but can also be used as the power means for driving a closed circuit hydraulic cylinder as shown in *Fig.* 1. Compressed air has been used successfully to drive the hydraulic pump on a power device where the absence of electricity is desired.

▸ But . . .

Some of the disadvantages of compressed air must also be pointed out. While moisture is not a problem on some compressed air installations, on others it is. Passage of air through pipes from a very hot room to a cold area may cause moisture to form. For example, an air line running from a heated building out to a loading dock where the temperature may be −20 F presents a problem. Condensation may form in the air line and freeze, causing damage to components of the air system.

Contrary to common belief, compressed air is not cheap, due to three factors:

1. Compressed air systems have a low efficiency.

2. Leakage around packings and gaskets is expensive and not always given immediate attention, since the leaks do not cause a mess, as hydraulic leaks do. Many air leaks go unheeded for long periods of time.

3. Carelessness by operators can also add to the high cost of compressed air. Operators often waste much air when using it to remove chips, and for cleaning purposes.

Compressed air does not lend itself to extremely fine feeds as does hydraulics. Air is a compressible fluid and reacts as such.

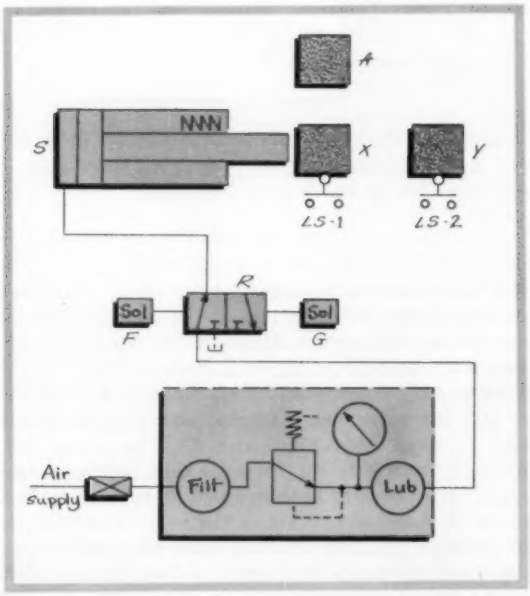


Fig. 2—System utilizing solenoid operated three way control valve and limit switches to move object A from point X to Y automatically.

▸ How To Use It

Since providing motion is one of the primary uses of compressed air, it will prove profitable to review some of the various aspects of this usage. Compressed air provides rotary, straight line, and angular motion. But what does it take to achieve it?

Compressed air as a means of motion is utilized in an air cylinder for straight line motion and in an air motor for rotary motion. Compressed air is also used as the mode of control over the means of motion.

Suppose it is desired to move an object between two points along a straight line. We must determine whether the means of motion, which contains an actuator, will be returned under its own power, by gravity, or by some external force such as a spring. This will have a bearing upon the type of controls to be used.

The system should contain a regulator, filter, and lubricator placed upstream of each individual circuit which will provide clean, regulated, and properly lubricated air for the circuit. This will pay big dividends in reducing maintenance and increasing efficiency.

Now to consider a circuit. Air flows from the supply line to the filter where dirt, water and other

impurities are taken from the stream. The air passes to the regulator and the operating pressure for the circuit is set. The regulated air then flows through the lubricator where a sufficient amount of lubricant is injected. The air then flows to the inlet of the three way control valve which has three ports—an inlet, a cylinder port, and an exhaust port. The control mechanism of a three way valve has two positions: In one position the inlet is connected to the cylinder port and the exhaust is blocked; in the other position the inlet is blocked and the cylinder port is connected to the exhaust.

Three way valves are classed as normally open or normally closed which refers to the condition of the inlet port in the normal position of the actuator. When the actuator connects the inlet of the valve to the cylinder port, air flows from the cylinder port of the valve to the port of the cylinder and the air pressure moves the piston. As the actuator is shifted back to the normal position (in a normally closed valve) the air pressure is released from the blind end of the piston and spring pressure returns the piston to the starting position.

Actuation of the valve may be accomplished by manual, electrical, or mechanical means. The latter two are most generally used in automation applications.

A simple circuit such as the one just described can be used in an automatic process as shown in *Fig.* 2. Here we make use of an electrically (solenoid) operated valve to provide the automatic sequence. The circuit functions as follows:

Object *A* moves down a gravity type conveyor until it comes to point *X*. Here it contacts limit switch 1 which in turn energizes solenoid *F* of valve *R* which shifts the valve piston and connects the inlet port to the cylinder port and air flows to the blind end of ejection cylinder *S*. The piston rod of the cylinder directs object *A* to point *Y* where object *A* is moved onto another conveyor. As the piston rod approaches the end of the travel, it contacts limit switch 2 which energizes solenoid *G* which shifts piston of valve *R* back to original position, releasing air pressure and allowing the spring to return the cylinder piston to the starting position, completing the cycle.

There are other ways to use valves to accomplish this same motion automatically, one of which is shown in *Fig.* 3. Here are the same basic pneumatic components but different electrical components. In this circuit object *A* contacts limit switch 1 which momentarily energizes solenoid *F* of valve *R* and the valve piston shifts, directing air pressure to blind end of cylinder *S*. The piston rod moves *A* from *X* to *Y*. Pressure then builds up, energizing a pressure switch which in turn energizes solenoid *G* and the piston of the valve is shifted to its original position blocking inlet pressure at the valve and allowing air to exhaust from the cylinder back through the valve. The spring returns the piston rod to the starting position.

A variation of this circuit is shown in *Fig.* 4 where the same basic pneumatic components are

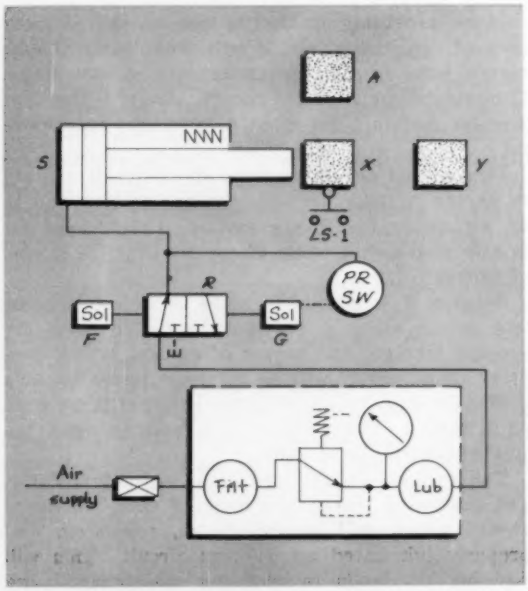


Fig. 3—System which utilizes a pressure switch to indicate completion of travel rather than limit switch 2 of *Fig.* 2.

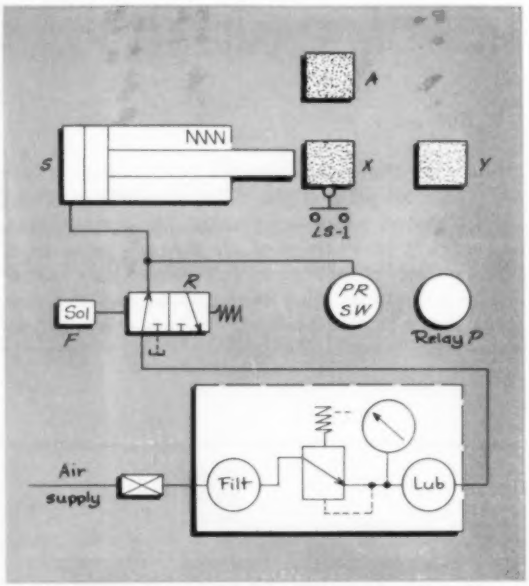
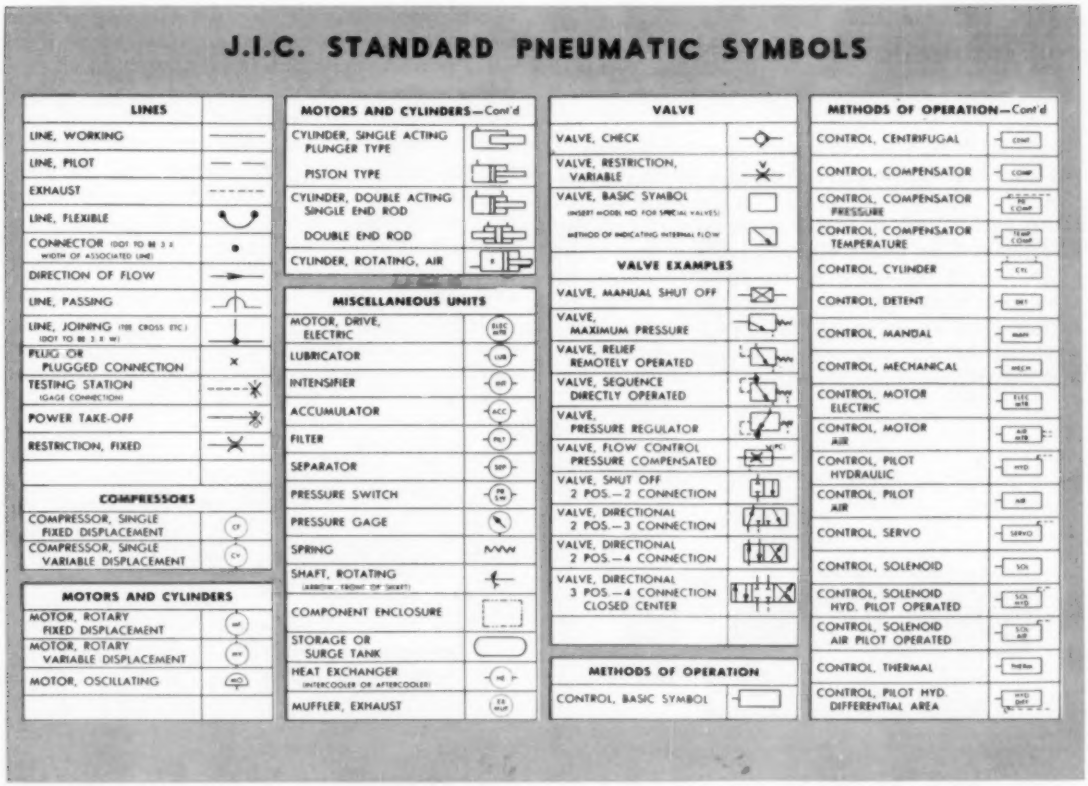


Fig. 4—Replacement of solenoid G of *Fig.* 3 is possible with use of a spring and holding relay.



used except that a single solenoid with spring return is employed. Here, when limit switch 1 is energized it in turn energizes a holding relay *P* which maintains current through solenoid *F* shifting the piston of valve *R* until the piston rod of cylinder *S* reaches the end of the stroke and pressure builds up. Full pressure energizes a pressure switch which deenergizes the relay, interrupting current to solenoid *F*. The valve piston is shifted by a spring back to its original position releasing the air from the blind end of the cylinder and the piston retracts.

A potential difficulty occurs in using circuits shown in *Figs.* 3 and 4 in that if some object hinders movement of object *A*, the pressure behind the piston will build up and cause the pressure switch to be energized before the cylinder piston reaches the end of the stroke. But this can be advantageous. It can save object *A* as well as parts of the machine from damage if some object should fall between positions *X* and *Y*.

Double Acting Cylinders

Object *A* can be moved from *X* to *Y* using a double acting air cylinder. The arrangement of such a circuit with manual operation of the valve is shown in *Fig.* 5. Object *A* slides down a chute and comes to rest on a table slide. The operator shifts the handle of four way valve *H* which connects the inlet port to cylinder port 1 and air flows to the blind end of feed cylinder *S* and object *A* is moved on a slide from point *X* at the chute end to point *Y* on a die. The operator shifts the handle on the valve to its original position and air flows from the inlet port to cylinder port 2 of valve *H* to the rod end port of cylinder *S* and the piston retracts. During the retracting period the air in the blind end of the cylinder is forced back through cylinder port 1 of valve *H* and out through the exhaust port to atmosphere. The piston returns to its original position and is ready for the next cycle.

To make the cycle automatic, there are several choices, all hinging on the valve selected—either an electrically operated or a pilot operated four way control valve.

For example, to move object *A* from point *X* to *Y* automatically, using pilot operated controls the circuit would be arranged as in *Fig.* 6. Object *A* is moved along a power conveyor to point *X* where its pallet trips the operating mechanism of two way pilot valve *C* which bleeds the air pressure from the pilot chamber *R* of pilot operated four way control valve *D*. The piston of the valve shifts causing the inlet to be connected to cylinder port 1. Air pressure flows to the blind end of pusher cylinder *G* and the piston rod moves pallet and object *A* to station *Y*. As the piston rod approaches the end of its stroke a cam on the end of the rod trips an operating mechanism on two way valve *E* which

bleeds air from pilot chamber *P* of valve *D* causing the piston of the valve to shift back to its original position. The inlet of valve *D* is connected to cylinder port 2 and air flows to the rod end of the cylinder and the piston retracts, completing a cycle.

To control the speed of the forward stroke so that some work can be done during this stroke an arrangement as shown in *Fig.* 7 may be used. Suppose that as object *A* is moved from point *X* to *Y* a brushing operation takes place. Here it is desired to move the object slowly through the brushes. Object *A* is moved on a pallet to point *X* where a cam momentarily contacts the operating mechanism of three way pilot valve *C*. Air pressure passes through the valve to pilot connection *V* on four way pilot operated valve *D*. Its piston is shifted allowing the inlet port of *D* to be connected to cylinder port 1 and air flows to the blind end of feed cylinder *G*. The piston rod of the feed cylinder starts the pallet and object *A* forward but the speed of movement is controlled by the air being ejected from the rod end of cylinder *G* which must pass through flow control valve *R* before it escapes to atmosphere. The speed of the piston rod is controlled by the size orifice that is set in the flow control valve.

After the object has been moved through the brushes and as the end of the stroke is reached, a cam on the piston rod contacts the operating mechanism of valve *E* and air flows through this valve to pilot connection *W* of valve *D* and the piston is shifted connecting the inlet port to cylinder port 2. Air flows freely through the check valve of flow control valve *R* to rod end of cylinder *G* and the piston retracts to the starting position.

If object *A* is to be moved at a rapid rate for a part of the travel between *X* and *Y*, and then at a slower controlled rate for the balance of the distance, there are several ways in which this can be accomplished. One is to use a cam operated flow control in place of the flow control as shown in *Fig.* 7. As soon as the cam roller is depressed, the speed rate of the piston movement will be changed.

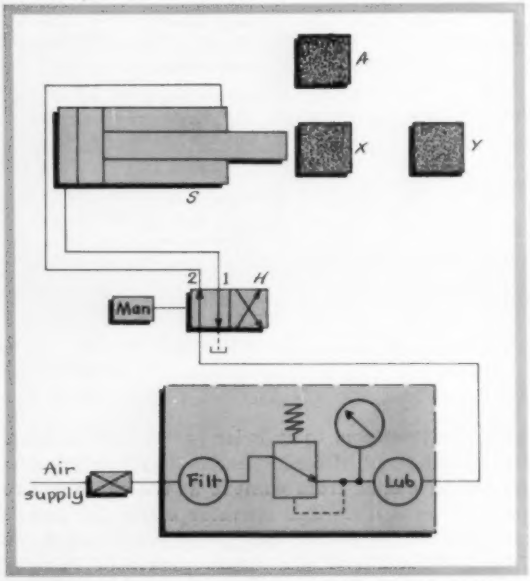


Fig. 5—Double acting pneumatic cylinder with manually operated valve to control flow of air into blind end and rod end of cylinder alternately.

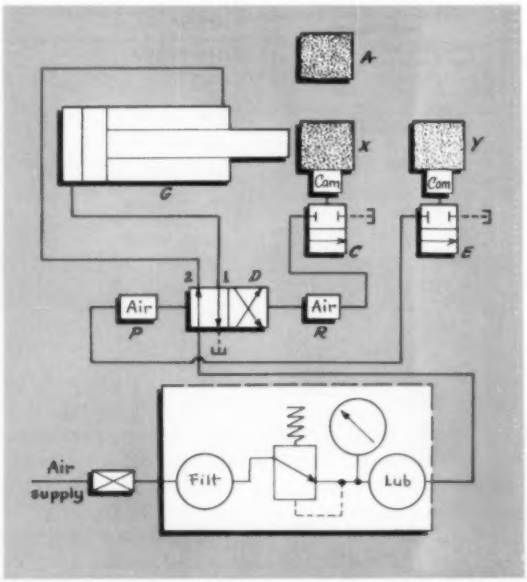


Fig. 6—Pilot operated controls and a double acting pneumatic cylinder provide a completely pneumatic system of both control and movement devices.

Another approach is to insert a solenoid operated normally open valve and a needle valve in the line between the cylinder and four way valve as shown in *Fig.* 8. When the cam contacts a limit switch the solenoid will close the valve and the exhaust air must pass through the needle valve.

If the cylinder is required to move the object between *X* and *Y* and then hold it there for a predetermined period of time before the piston retracts, use of a solenoid operated four way valve plus a timer is a possible solution.

Cylinder Mounting

In designing a circuit it is wise to select a cylinder, either single or double acting, which will lend itself most naturally to the installation. For ex-

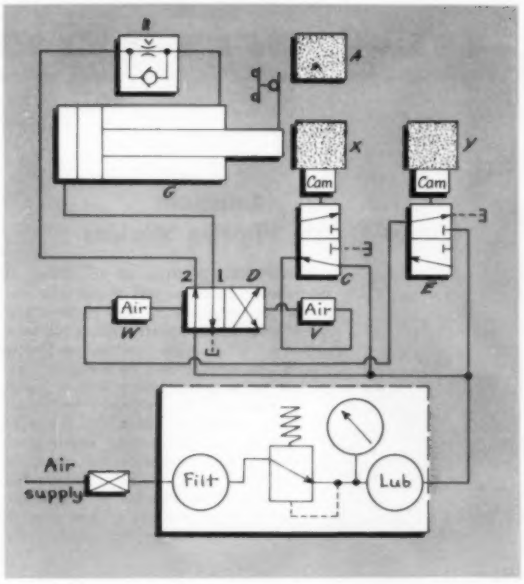


Fig. 7—Pneumatic flow control valve *R* introduced to control the speed of movement between *X* and *Y*. Speed is controlled by metering the flow of air from the rod end of the cylinder.

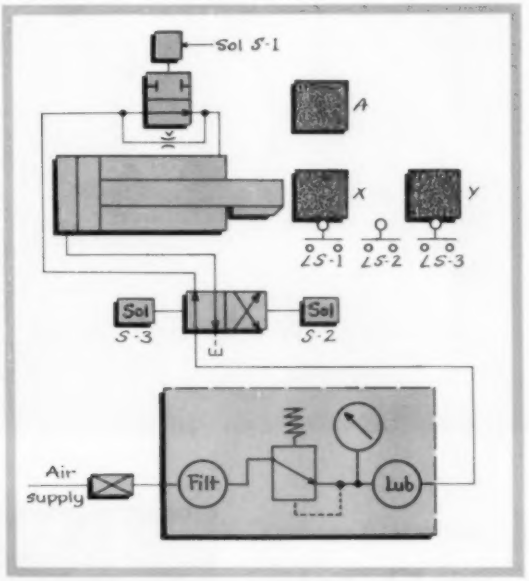


Fig. 8—Use of a solenoid operated valve to control speed through a portion of the total movement. Speed will be rapid until LS2 is contacted then controlled when exhaust air from the rod end of the cylinder must pass through the needle valve.

ample, to move an object that must swing in an arc, select a cylinder with a clevis or trunnion mounting, not one with a fixed mounting such as foot, centerline or flange. By using the pivoted type mounting, the rod bearing, piston rod, packing, and piston are relieved from side thrust. Many failures of pneumatic cylinders can be attributed to improper selection of cylinder mounting style or to insufficient strength in brackets, plates, and other supports. Cylinders are capable of applying considerable force and often this force is imparted with a hammer-like blow causing strain in the mounting supports.

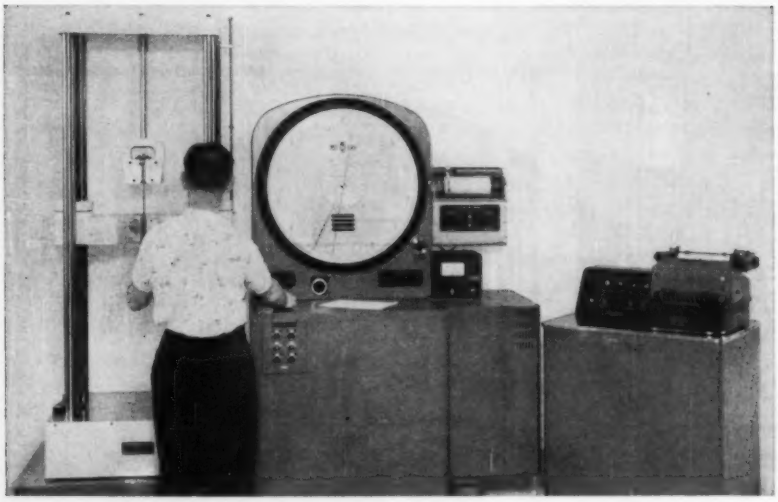
Using cushioned cylinders helps to alleviate the sudden impact between piston and the cylinder covers. This also helps to protect machine elements connected to the end of the piston rod of the cylinder. The length of the cushion depends upon several things such as the speed of piston travel, the load being moved, and the method of supporting the load, etc.

In the next article, we will discuss further movements of object *A*. As this series progresses we will go into the more complicated movements that can be automatically performed by air equipment.

What's Your Problem?

DO YOU HAVE a knotty problem in your automatic operations or those you plan to install? The AUTOMATION Problem Forum, a special feature department to be found on Page 34 of this issue, offers a unique service in which you will be interested.

To avail our readers of automation information and to tap the vast reservoir of practical know-how across industry, editorial space is devoted to the presentation of both problems and suggested solutions to the problems. This free exchange of ideas and information, as can be seen from the format of the Problem Forum, can be accomplished without violating the rights of privacy of individuals or firms. Why not take advantage of this service—what's your problem?

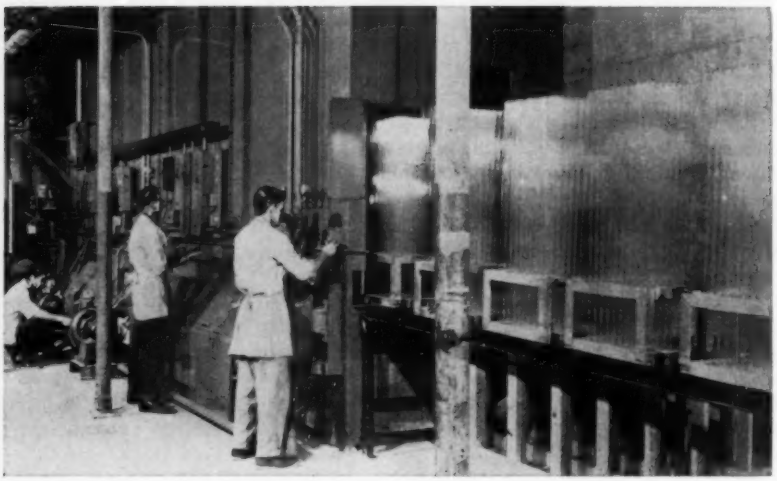


Automatic Testing Machine

PHYSICAL TESTING of a number of similar specimens is considerably improved by use of newly developed Tinius Olsen universal testing machine. The testing system includes a Fischer & Porter Co. analog-to-digital converter, a programming unit, a signal device and an automatic typewriter. After setting the controls for a desired run of tests, the operator inserts specimens. Results of each test are typed on a log sheet with an identifying test number. Interpretation of stress-strain curves is not necessary as yield strength and ultimate strength are automatically typed out.

Light Tube Washer

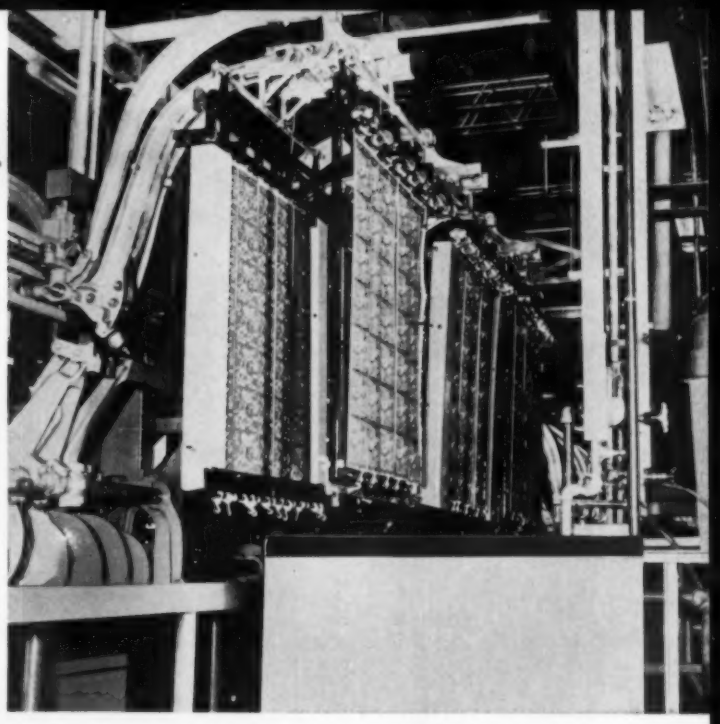
UNFINISHED fluorescent light tubes of various sizes are cleaned at production rate of 3000 pieces per hour by equipment designed and manufactured by Industrial Systems Co. The glass tubes are placed vertically into racks and fed into the machine by conveyor. The three-stage cleaning cycle includes a wash with detergent solution, clean rinse, and drying operation after which parts are conveyed to next step in production operation. Necessary heat is supplied by gas.



Data Handling in Refinery

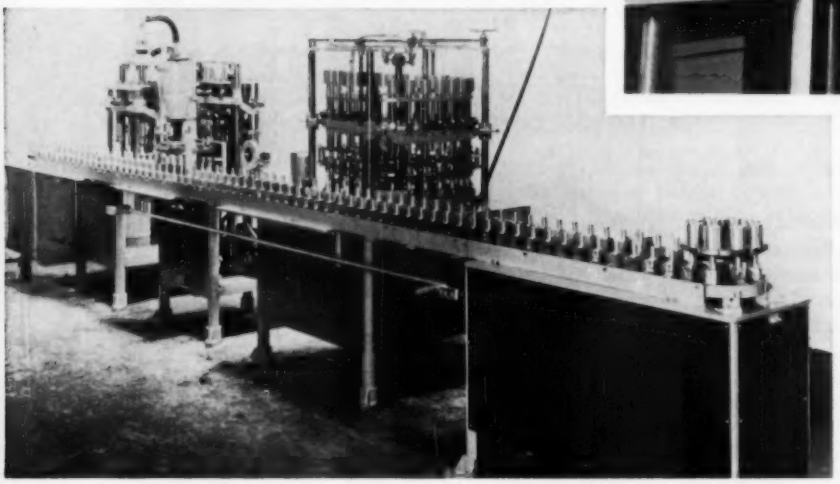
MARKETING-DATA processing center has been established by Esso Standard Oil Co. The system is similar to the pictured computer installation located at an Esso refinery. The new installation will receive marketing data from the company's ten sales division headquarters by leased telephone wires. After compilation and evaluation, necessary reports will be returned by leased wires to the sales offices. The IBM 705 center is designed to improve over-all accounting, reporting and customer service by furnishing information to management more speedily.

in action



Plating Printed Circuits

OVER five million circuit boards can be produced annually on equipment developed by Frederic B. Stevens Inc. The plating tank, 75 feet long, produces copper-plated circuit boards. The transfer means is equipped with arms that hold two racks; each rack holds 24 plastic boards in position for electrolytic deposition of the wiring pattern.

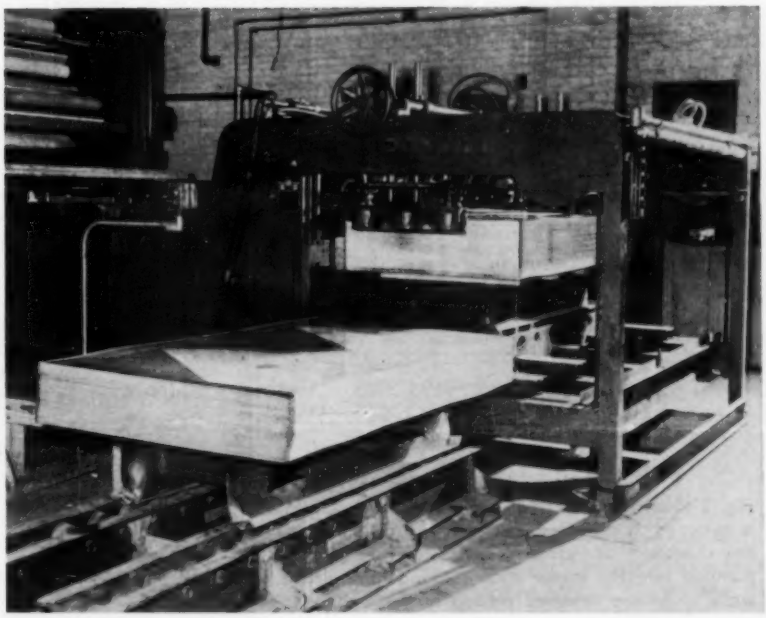


Ink Cartridge Production

IN COLLABORATION with MRM Co., which built the machines, the W. A. Sheaffer Pen Co. has installed automatic equipment to fill, select a tiny plug for capping, and heat seal an ink cartridge measuring approximately ¼ inch in diameter and 2 inches in length. Basically, the machine consists of three stations linked with a continuous chain conveyor that has been provided with individual holders to accept the cartridges. The cartridges are filled automatically by a rotary vacuum filling machine at production rates up to 200 units a minute. Finished cartridges are removed at a station provided with an air discharger.

Sheet Metal Feeder

STEEL SHEETS to be decorated prior to being formed into drums are fed to the decorating machine at rates to 4200 sheets per hour by equipment built by Dexter Folder Co. At an Inland Steel Container Corp. plant, pallet loads weighing up to 7½ tons are deposited on the feeder's service conveyor. The load is rolled forward to the feeder platform. The 50-lb sheets are lifted by vacuum cups and introduced into the rollers of the decorating machine. The load continuously rises as sheets are removed. Magnets mounted alongside the load aid sheet separation by causing adjacent sheets to be magnetized with like charges, causing top sheet to float off the pile.



FILTERING COOLANT AUTOMATICALLY

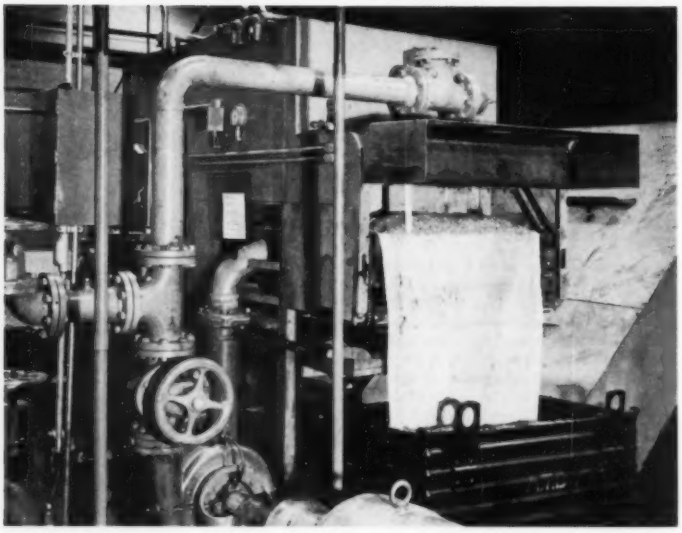


Fig. 1—Automatic coolant filtering unit pictured with hood propped open to show chips and used filter web being dumped into disposal container. Dumping cycle is automatically carried out when filter back pressure reaches a preset level.

UNLESS AUXILIARY FUNCTIONS can be performed automatically the effectiveness of automatic production machines may be seriously impaired. One answer to the auxiliary problem of economically supplying clean coolant to a transfer machine is shown in *Fig.* 1. The unit shown was built by Hydromation Engineering Co. and is an automatic filter which removes aluminum chips from the soluble oil coolant used on a transfer machine built by Buhr Machine Tool Co. for the Ford Motor Co. The transfer machine is used to machine aluminum transmission extension housings and the Hydromation unit is used to filter 700 gpm of coolant for re-use on the transfer machine. Operation of the filter unit is completely automatic.

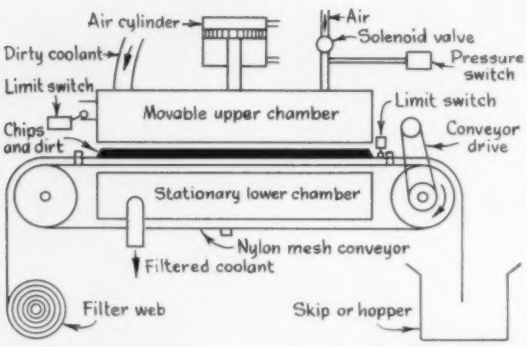


Fig. 2—Sketch shows how the filter web is supported by a nylon mesh conveyor, between two chambers. When the chambers are closed on the filter web, coolant is pumped into the upper chamber and through the web while chips are retained on top of the web.

Construction of the filter unit is illustrated in *Fig.* 2. Basically it consists of two chambers separated by a paper filter web. The filter web is supported by a nylon mesh belt conveyor which is stopped for filtering and moves to dump chips and the used filter web. Chip-bearing coolant from the transfer machine is pumped into the chamber above the filter web. Coolant is forced under pressure through the web to the lower chamber while chips are retained on top of the web. The coolant is then returned to a reservoir for re-use. As material is deposited on the filter web, the pressure in the upper chamber rises until a pressure switch initiates a series of steps to index the filter.

The automatic steps in the filter index are as follows: 1. Coolant supply to the filter is stopped. 2. Air is blown into the inlet chamber for a timed interval to force remaining coolant through the filter. 3. When the timer has timed out and pressure in the unit has dropped, the air cylinder raises the upper chamber. 4. When the upper chamber is fully up, a limit switch starts the conveyor. 5. When the conveyor belt has moved the length of the chambers, a limit switch is actuated which stops the conveyor and causes the air cylinder to lower the upper chamber. 6. When the chambers are together, with the filter sealed between them, dirty coolant is again pumped into the top chamber until the next filter index is initiated.

Time required for the filter index is approximately 20 seconds. During the time of indexing the machining operations are supplied with coolant from a reservoir. Automatically filtered coolant is thus available continuously and the transfer machine operation need not be limited by coolant supply.

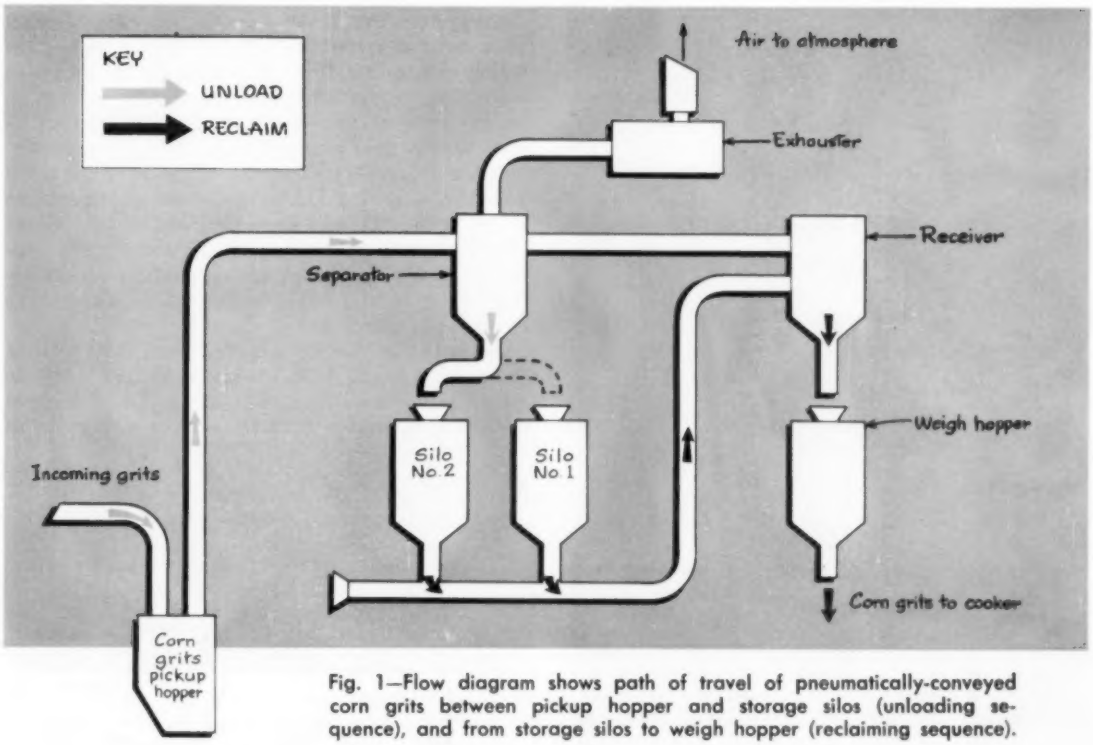


Fig. 1—Flow diagram shows path of travel of pneumatically-conveyed corn grits between pickup hopper and storage silos (unloading sequence), and from storage silos to weigh hopper (reclaiming sequence).

PNEUMATIC CONVEYING OF GRAIN

MODERNIZES BREWERY OPERATION

HANDLING BULK INGREDIENTS for prepared food and beverage products places the requirement for extreme sanitation as well as efficiency of operation on the handling arrangement. In fact, protection of the raw materials against contamination and infestation may well rank foremost among the conditions which must be met by a handling system in this service. In taking over a recently acquired brewery, Piel Bros. was faced with a modification program which would bring plant operations up to modern sanitary standards. They had the additional responsibility of providing rigid control of quality of the product. This was necessitated by the fact that the same brand of beer was being produced in an existing brewery at another location—a uniform, identical product had to be turned out by the new plant.

With the factors of sanitation, efficient handling and quality control in mind, Piel's management decided to replace the existing complicated screw and bucket-elevator system for conveying coarse corn grits and malt inside the plant with two separate pneumatic conveying systems. The systems, built by Fuller Co., complete a bulk-handling sequence which includes: Bulk delivery of ingredients in sealed boxcars to a railhead a mile from the plant; emptying of the boxcars by self-filling transfer trailers, using flexible tubes and nozzles which are inserted in the cars; and sealed delivery to the yard-level pickup hoppers at the brewery.

Grits-Handling System

Coarse corn grits, delivered to the brewery in 22,000-pound lots by transfer trailer, are discharged by gravity into the pickup hopper of the grits-han-

Fig. 2—Separator on roof of brewery extracts corn grits from conveying air stream and passes them through a rotary lock to preselected storage silo on floor below.

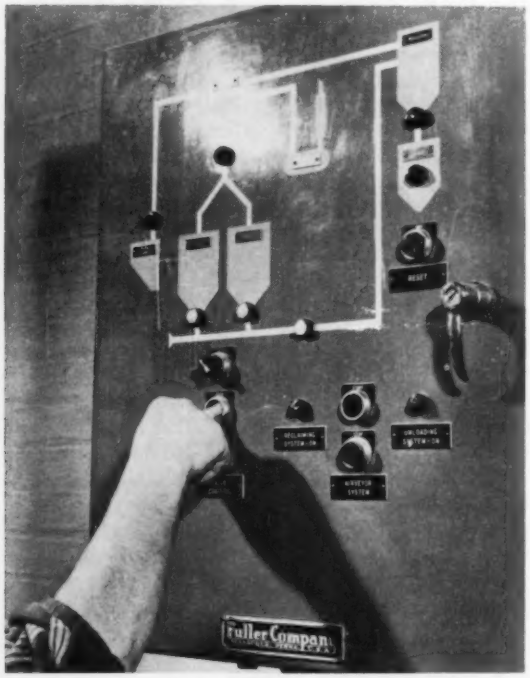


Fig. 3—Grits-reclaiming control panel in the cooking room. Operator selects silo to be emptied and starts system to convey grits pneumatically to weigh hopper. Graphic representation of system simplifies operation of the controls.

dling system, *Fig.* 1. An operator at a control panel then activates the Roots-type positive exhauster which creates air flow, and grits are lifted pneumatically through ducts to the separator, *Fig.* 2, on the roof of the building. System capacity is such that 20 tons of grits can be unloaded per hour.

After separation from the air stream the grits pass through a rotary discharge lock at the bottom of the separator and drop into one of two preselected storage silos. Stream air leaving the separator is drawn through an automatic, continuous-type filter before being discharged to atmosphere by the exhauster.

When the level of grits in the storage silo reaches the desired height, a Fuller material-level indicator activates a signal light on the unloading control panel and sounds a horn to warn the operator to

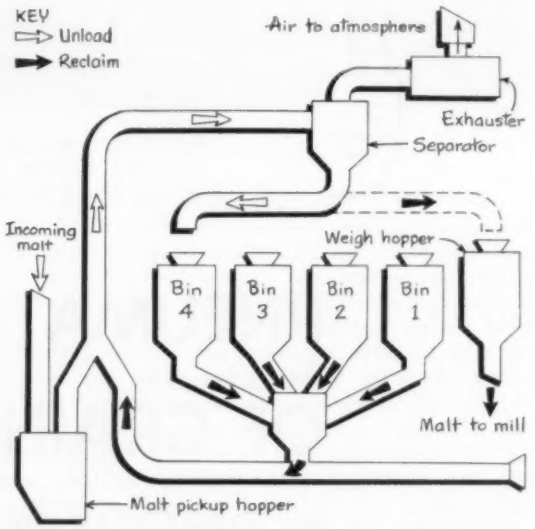


Fig. 4—Operations of unloading and reclaiming malt are similar to those for corn grits, as shown by this flow diagram of malt-handling system.

stop the flow of grits into the pickup hopper. If the warning is ignored the system is shut down automatically.

Reclaiming of corn grits from the storage silos to the weigh hopper is regulated from a control panel, *Fig.* 3, in the cooking room. There, the operator in charge of mashing sets a switch on the panel to select the storage silo from which he will reclaim grits, and operates a pushbutton to open its valve. He then presses a *Start* button and the exhauster restarts, this time to draw a stream of grits from the silo into a receiver. From the receiver, grits drop by gravity into the weigh hopper. When sufficient grits have accumulated in the hopper the flow is stopped automatically and the operator is free to discharge the batch into the

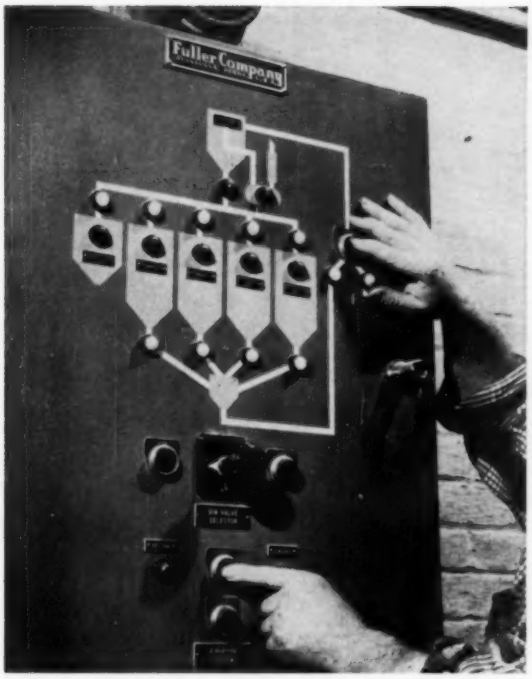


Fig. 5—Control panel in the mashing room by which operator reclaims malt from preselected storage bin to weigh hopper.

cooker. Five to six tons of material may be reclaimed in this manner each hour.

Malt-Handling System

Unloading procedure for the malt-handling system, *Fig.* 4, is similar to that for unloading corn grits. An operator at a control panel located close by the malt-pickup hopper sets a switch which determines which of four 20,000-pound capacity storage bins will receive the malt. He then sets the system in operation by pressing a *Start* button and malt is pneumatically conveyed from the pickup hopper through ducts to an overhead separator, from which it drops into the preselected storage bin. Since malt is a more abrasive material than corn grits, the outside curves in the malt-conveying ducts are fitted with replaceable rectangular wear plates of hardened steel. A level control in the storage bin actuates an alarm when the bin is full, and the operator stops the flow of malt into the pickup hopper. If he fails to do this the system will be shut down automatically.

Reclaiming of malt is accomplished in a manner similar to that for corn grits reclaiming. The mashing operator, from a control panel in the mashing room, *Fig.* 5, reclaims malt from any of the four storage bins to the weigh hopper from which it is discharged to the mill. The Roots-type positive exhauster which generates an air flow for all of the malt-conveying action is shown in *Fig.* 6.

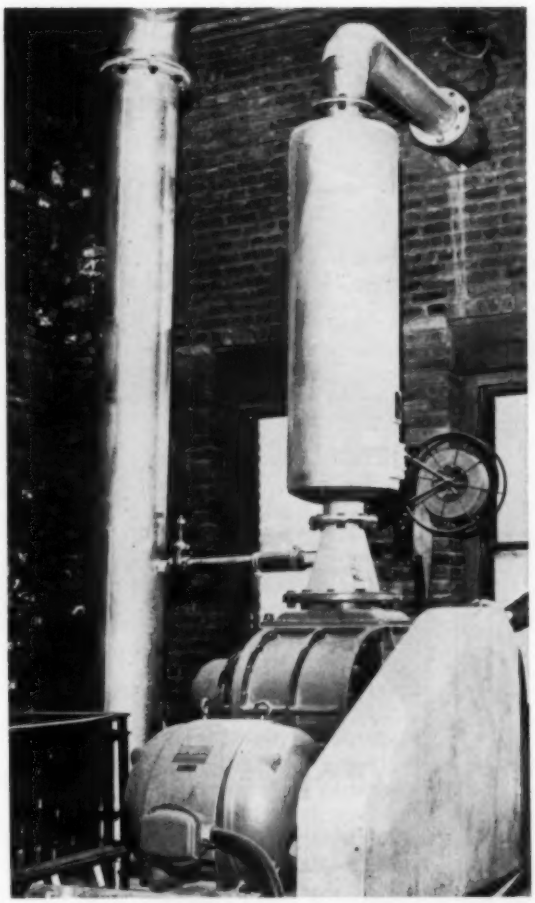


Fig. 6—Roots-type positive exhauster which generates air flow for conveying malt in unloading and reclaiming operations.

Many Benefits

Use of pneumatic vacuum conveying equipment for corn grits and malt provides many advantages over methods previously used in this brewery. Prior to installation of the two automatic handling systems, all conveying in the plant was done by a complex screw and bucket-elevator system. Among the disadvantages of the older system was the difficulty of maintaining sanitation—cleaning alone required eight manhours a week. In contrast, the new systems are self-cleaning, and no dust migrates from the conveying ducts to settle in and around the brewery. This, combined with the fact that fewer mechanical handling devices are used, has allowed a reduction in the cleaning force. Men formerly assigned to cleaning have been retrained and transferred to more productive jobs. Foolproof unloading, made possible by the installation on each bin and silo of material-level indicators, which automatically shut down the conveyors on overfill, is another important advantage of the new handling systems.

DIMENSIONAL CONTROLLING SYSTEMS

1

IN-PROCESS GAGING

PROVIDES RELIABLE MACHINE CONTROL

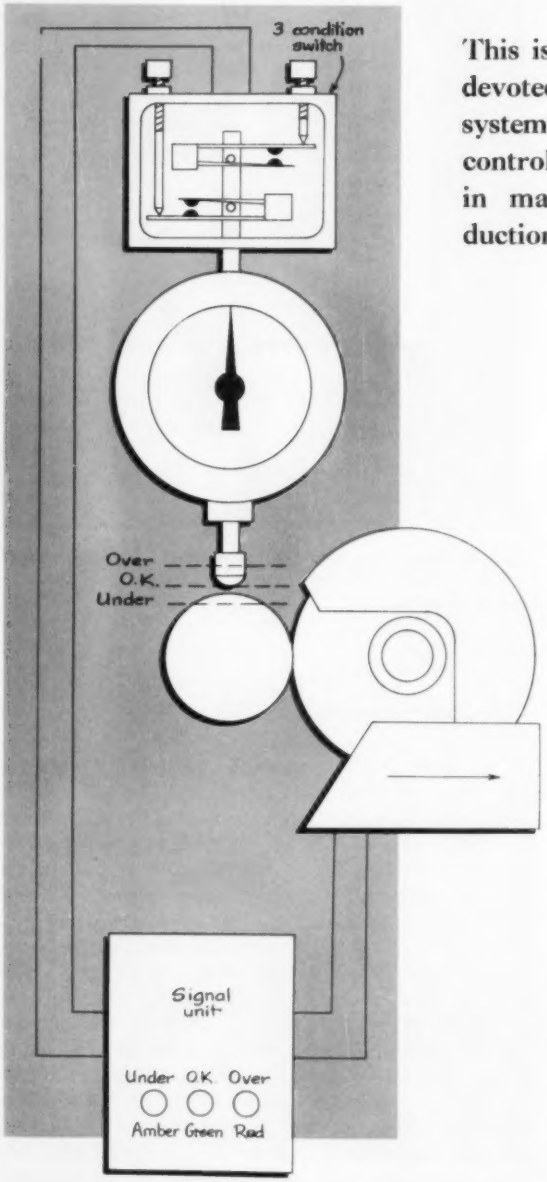


Fig. 1—Diagram illustrates use of electric control system applied to control of grinder. A dial indicator and dual switch mechanism are combined to provide control of the machine tool.

This is the first article in a series of three to be devoted to the subject of dimensional controlling systems. Here the author discusses means of controlling machines to obtain a noteworthy goal in manufacturing operations—economical production of nothing but good parts.

By R. ALLEN SOULER,
Automatic Gage Engineer, Federal Products Corp., Providence, R. I.

DEVELOPMENTS in gaging have paced industrial progress from the time that the theory of interchangeability of parts resulted in mass production. It is no different today. Automation is advancing through the application of fast, flexible, and precise gaging systems. In the field of machine tools, refinements leading to more automatic machines have been matched by ingenious developments in gaging equipment—developments permitting the use of gaging systems to control machine functions.

In accomplishing self-correction, a machine tool can be fitted with in-process gaging, post-process gaging, or a combination of in-process and post-process gaging equipment. The first type of system is an integral part of the machine tool and gaging is performed while a workpiece is being machined. The second type of system is conveniently located in relation to the machine tool and gaging is performed on the workpiece after it has been ejected from the machine.

In-process gaging will be discussed in this first of three articles on automatic gaging systems. Properly applied, in-process gaging devices measure pieces during metal removal and control the tool so that satisfactory work is produced automatically. The extent of control depends basically on the type of control system installed. As an example of the capabilities involved, gages used for in-process gaging in a grinding application can

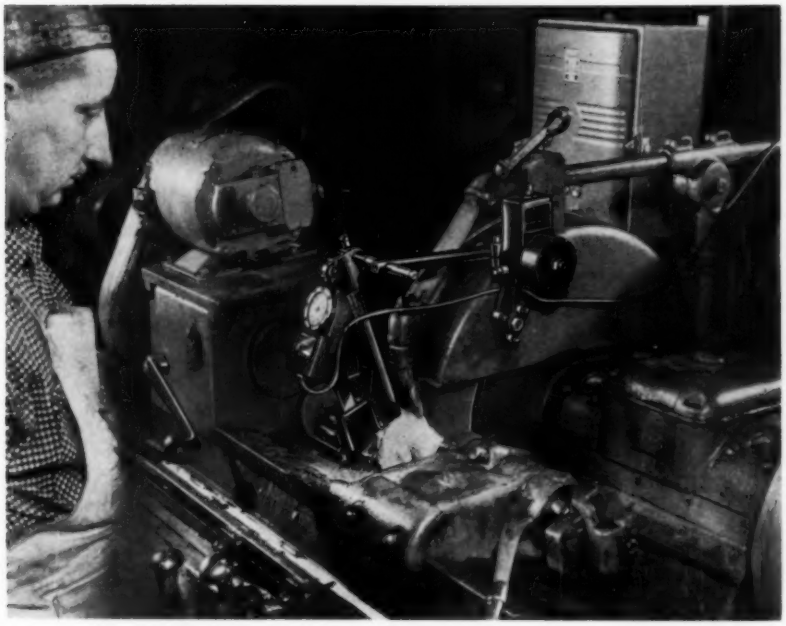


Fig. 2—Electric control system changes grinding wheel feed rate from fast to slow feed when part is near size and retracts wheel when part reaches finish size. Workpiece is splined drive shaft.

perform these four functions automatically: 1. Change grinding wheel feed rate from roughing to finishing speeds. 2. Retract the grinding wheel when the workpiece reaches finish size. 3. Start the wheel dressing cycle of an internal grinder when the part has reached near size. 4. Signal visually or audibly when work is over, near, and at finish size.

▶ Electric Control Systems

The four principal types of gaging systems used for in-process machine control are electric, air-electric, electronic, and air-electronic.

The electric control system has the advantage of lowest initial cost. It is capable of gaging to an accuracy of 0.0005 inch, and even down to 0.0002 inch or less when desired.

The electrical control system, *Fig.* 1, combines the functions of a dial indicator with a switching mechanism which accurately links the movement of the gage contact with an electrical impulse. Such a system provides continuous visual indication of work size and requires only one master for proper setting. Some designs operate on line voltage, while in others switching current is reduced in order to eliminate sparking, burning and pitting

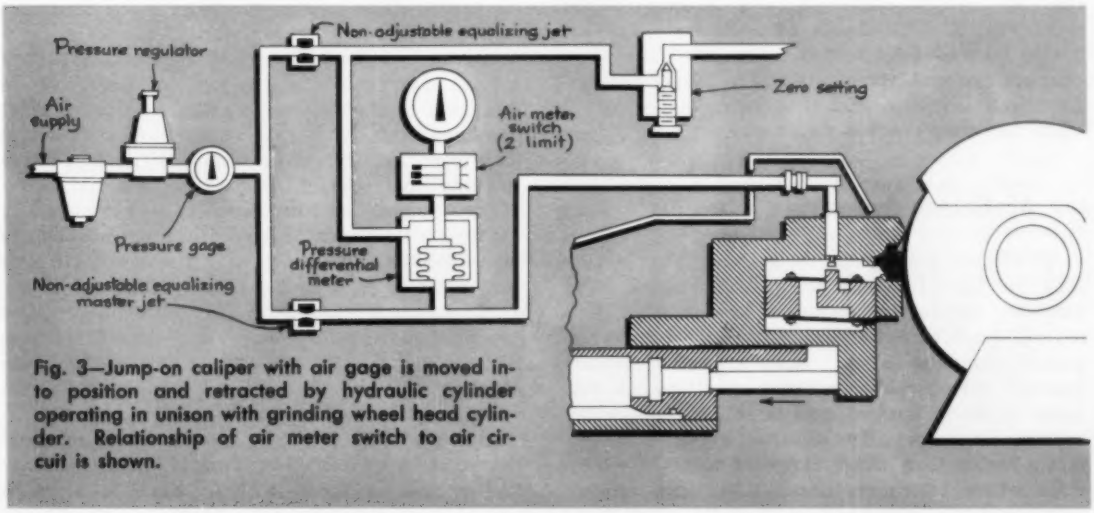


Fig. 3—Jump-on caliper with air gage is moved into position and retracted by hydraulic cylinder operating in unison with grinding wheel head cylinder. Relationship of air meter switch to air circuit is shown.

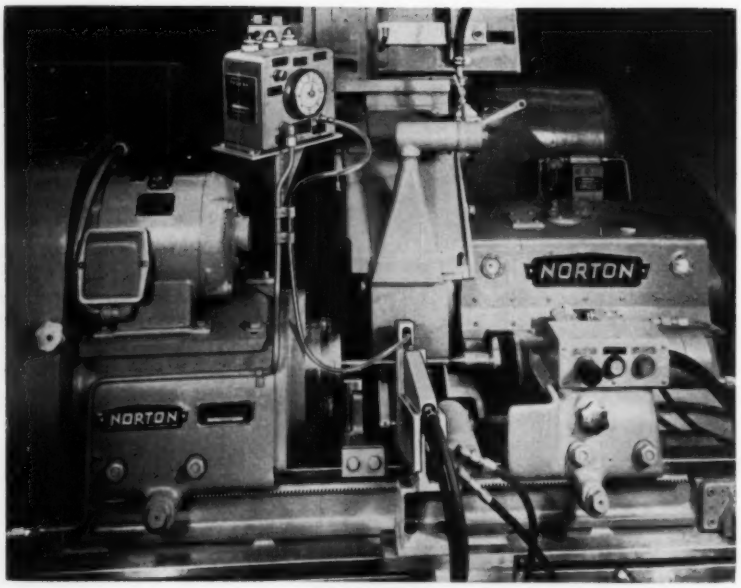


Fig. 4 — Grinding operation for rotor shaft of electric motor is controlled by air-electric gaging system. This is essentially a photograph of the diagram shown in Fig. 3.

of contacts. The switching limits are set according to specified tolerance limits.

Single-limit or double-limit control may be provided. A gage with single-limit control retracts a grinding wheel or cutting tool when work reaches finish size. Lights on the signaling unit show over size, near size, and finish size. With double-limit control, the feed rate of the wheel can be changed from fast to slow and the wheel retracted when work reaches finish size. The change in wheel feed comes at a time when the part being ground reaches near size and provides a slower feed rate for the finish-grinding operation. As with the single-limit control, lights will indicate the size classification.

Electric gaging systems are restricted in application largely to external grinding operations. For example, in grinding splined automotive driveshafts the part is gaged continuously by a grinding gage caliper connected to a two-limit signal unit, *Fig.* 2. The limits of tolerance are plus 0.0000, minus 0.0003 inch. The control system changes the wheel feed rate at the proper moment for dwell grinding and then retracts the wheel when the part reaches finish size.

▶ Air-Electric Systems

Air-electric gaging control systems, *Fig.* 3, combine the advantages of air gaging with those of electrical control to produce a system which has several important improvements over control by purely electrical means. Such a system usually provides considerably smoother operation, permits more extensive control, and is capable of greater repetitive accuracy. The air-electric gaging system is applicable to a wider range of machine operations where tolerances under 0.002 inch are involved. It is usually selected for internal gaging or where contact between the workpiece and the gaging head is undesirable.

Air-electric control gaging operates through several types of sensing devices, permitting considerable latitude in gaging design. These sensing devices can be single or multiple jet air rings and plugs or air probes. Differences in size, as sensed by an air probe, air ring or plug, are fed into air-electric switches, which convert air pressure variation into an electrical signal. Switches are available in single, double, and four-limit capacities or in any combination.

The single-limit system can be applied to recently designed external grinders now in operation, in which the gage provides for wheel retraction. Double-limit control gages are usually supplied through the machine manufacturers as original equipment and, as mentioned previously, include wheel retraction and a change in wheel feed rate as the part reaches near size.

On internal grinders, both single and double-limit control gages are usually supplied only on new machines. A double-limit gage can be used to start the dressing cycle of the grinding wheel when the part reaches approximate size and retract the wheel when final size has been reached.

For example, an air-electric gage automatically controls a cylindrical grinder finishing rotor shafts of an electric motor, *Fig.* 4. Tolerances of 0.0004 inch must be held on the outside diameter of the work. With a jump-on caliper and air probe, a two-limit meter-switch and a signal unit, the system changes the wheel feed rate from fast to slow as work reaches near size and retracts the wheel when finish size has been reached.

In the process of producing continuous material the importance of maintaining dimensional control is just as great in many cases as it is in

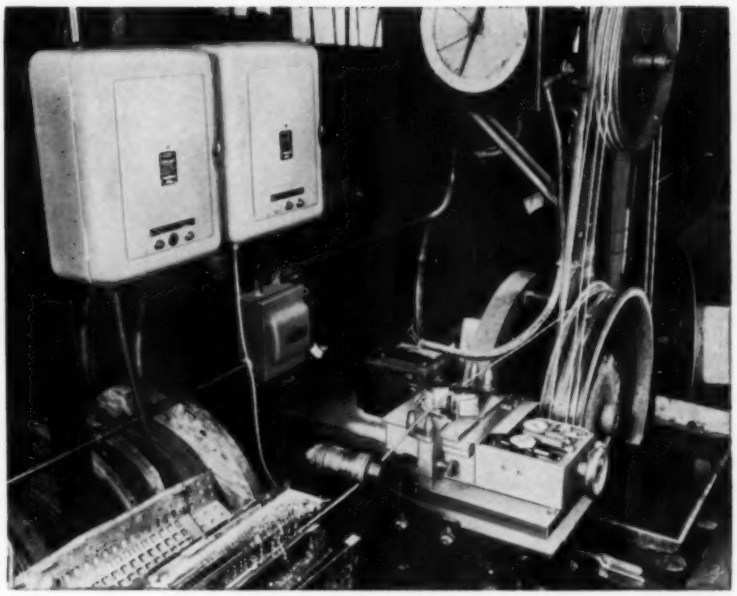


Fig. 5—Electric gaging control of continuous wire coating process. Function of gage control is to alter speed of a take-up capstan which draws wire through the coating machine.

controlling the dimensions of individual workpieces. In some instances tolerances may be less critical but the basic value of maintaining uniformity and avoiding waste is still very important.

Since continuous process applications normally involve external dimensions, either the electric or air-electric system is normally employed, depending on accuracy and speed requirements. The gaging units are similar to those previously described except that an auxiliary unit is required, and in addition, the gaging head is usually equipped with a roller arrangement which contacts the material being gaged. Examples of continuous process control are shown in *Fig.* 5 and 6.

▶ Electronic Gaging Control

Electronic gages are somewhat higher in initial cost than the two gages previously described, but are capable of greater accuracies, working to tolerances of 0.0002 inch or less. Less frequently specified than electric and air-electric systems, electronic gages are used primarily in special applications when measurements are complicated, as, for example, when the surface has intentional ovality or is otherwise irregular. Gages of this type are usually designed to the specific needs of a user.

The basic elements of an electronic gage system

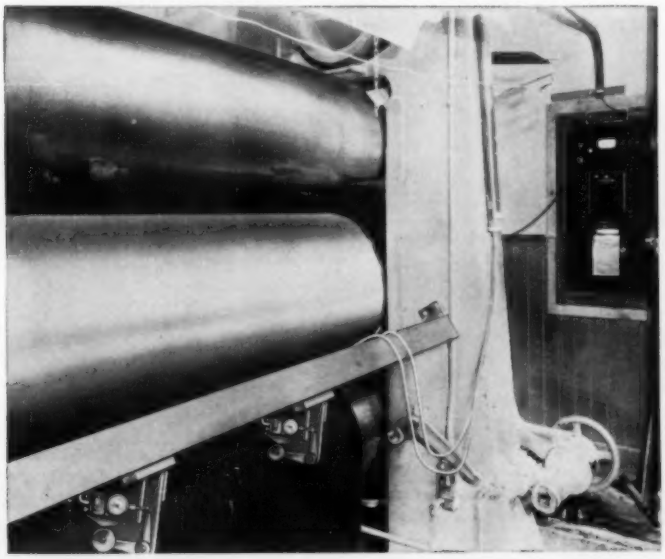


Fig. 6—For continuous process control of calendering operation, two independent electric gaging heads are equipped with roller contacts. The gages control adjustment of jackscrews to alter spacing at either end of rolls in varying the thickness of material.

include:

1. An electronic gaging head that produces a continuous electrical signal whose amplitude varies directly with spindle displacement. Such a linear calibrated system is inherently capable of high amplification and exceptional accuracy.

2. An electronic amplifier that provides linear amplification and rectification of the ac signal voltage to dc for operation of a calibrated meter, signal lights and a classifier. Magnification of up to 15,000 times is available.

3. An electronic classifier that operates from the amplifier to provide size classification and appropriate relay action for machine control.

For in-process machine control, electronic systems are used on external grinders to provide the same single or double-limit controls as electric and air-electric systems. The greater capability of the electronic machine control gaging system permits it to measure one dimension (e.g. the major OD of a cam ground piston) while ignoring a second or minor dimension and to electronically average two dimensional variables.

For example, a cylindrical grinding operation is controlled through two electronic heads on a special caliper, an amplifier, and a four-limit classifier, *Fig. 7*. The part being produced is a cam-ground piston on which the major OD had to be held to tolerance limits of plus 0.000, minus 0.0005 inch. Ignoring the minor diameter, the gage changes the feed rate and retracts the wheel when the major diameter reaches finish size. The gage electronically compensates for any contact movement caused by eccentricity.

Air-Electronic Control

The air-electronic gage is used primarily for measurements at comparatively high speeds and is particularly useful where a continuously variable gaging signal is required. The system has found limited use for in-process applications because the other systems have been adequate for present needs.

Air-electronic gaging utilizes the same gaging units as the electronic system, except for the gaging head and the addition of a transducer. The transducer transforms air pressure variations into continuous electronic signals of correspondingly changing amplitudes.

Post-process gaging and combination gaging control systems will be discussed in forthcoming issues.

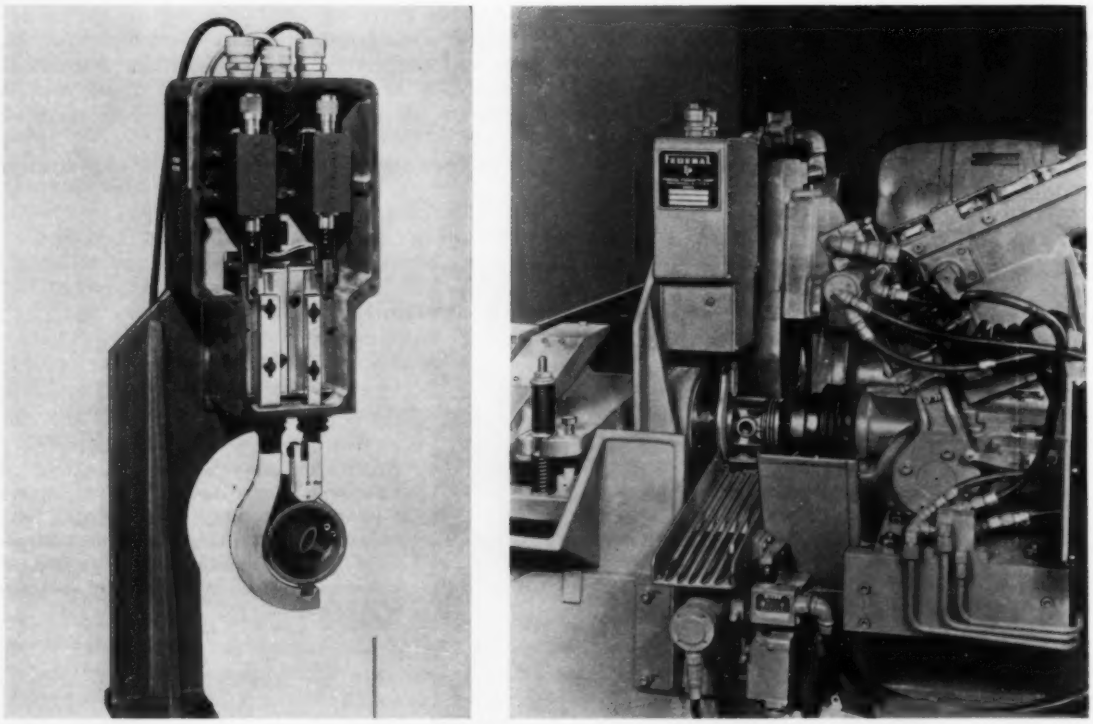
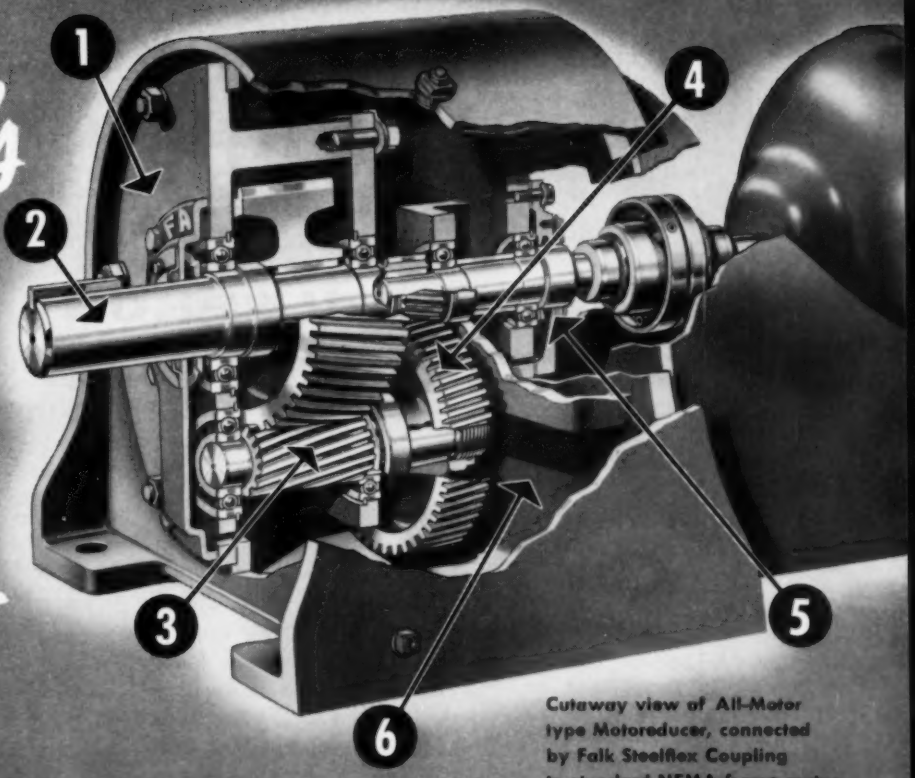


Fig. 7—Example of electronic gaging control of piston grinding operation. The gaging equipment includes two electronic heads which measure the major diameter of the oval part; the gage ignores the minor diameter in controlling the grinder.

Here's the inside story—



Cutaway view of All-Motor type Motoreducer, connected by Falk Steelflex Coupling to standard NEMA frame motor

WHY Falk Motoreducers give better service—have longer life

Here is the "inside story" behind the all-steel All-Motor type FALK Motoreducer's universal reputation as a gear drive unmatched in quality, efficiency, dependability, ease of maintenance and long life. These "In-built" factors are—

1 **ALL-STEEL HOUSINGS.** Rugged, strong, rigid...all parts are manufactured from heavy steel plate, formed and welded in the Falk Weld Shop.

2 **LARGE OVERHUNG LOAD CAPACITY.** Large shafts, oversize bearings...rigid mountings with wide bearing spans to handle maximum applied loads.

3 **PRECISION GEARING.** Heat-treated alloy steel gearing, precision cut and shaved after heat treatment to eliminate distortion. Quiet, crown-shaved pinions.

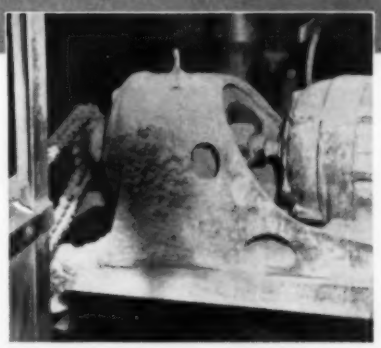
4 **EXTRA-CAPACITY GEARING.** Special extra-capacity gear-tooth form with larger contact area gives greater strength, higher load-carrying capacity.

5 **SEALED HOUSINGS.** Splashproof, dustproof, oil-tight construction. Dual closures and one-way vents keep oil in, dust and moisture out.

6 **POSITIVE LUBRICATION.** Large sump capacity...oiltight construction assures clean lubricant...revolving elements lubricated by direct dip.

When you buy or specify the All-Motor type FALK Motoreducer, you get all these—plus the tremendous advantage of full interchangeability of motors. Switch motors as desired—use any make, style or type of standard foot-mounted motor within the unit's AGMA rating—with a minimum of difficulty or "down time."

Available in sizes up to 75 hp—*with or without motor*—from convenient factory, field or distributor stocks, from coast to coast. **Write for Bulletin 3100.**



60,000 HOURS WITHOUT A FAILURE!

Sixty thousand hours is a lot of hours—but the FALK Motoreducer in the unretouched photo above has served that long without failure or need of repair.

This 3 hp unit is one of over 60 FALK Motoreducers in daily service in an Eastern plant of a large milling company, whose president says, in part:

"One of the main advantages of FALK Motoreducers is their adaptability to any motor. Reducers and motors can be easily interchanged....Our service records confirm the wisdom of our choice of FALK equipment as our standard."

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- Contract Machining

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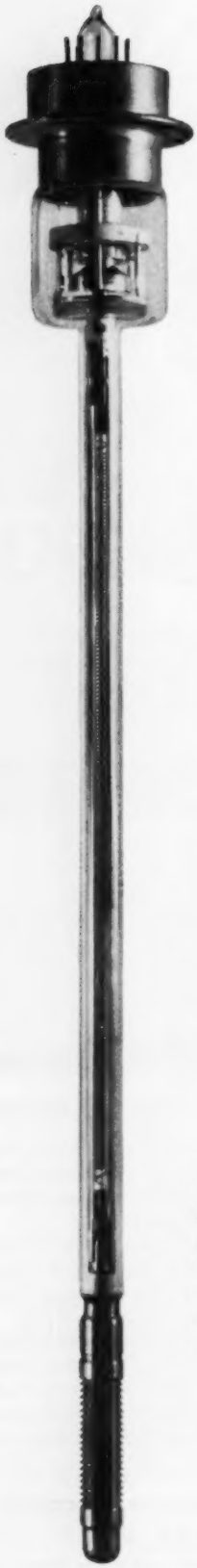


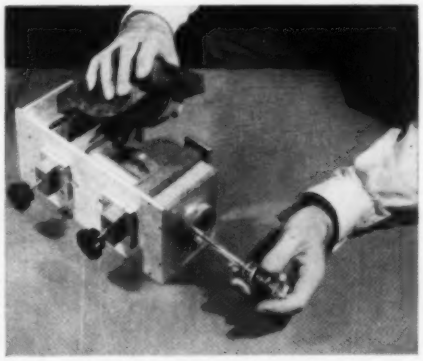
A GREAT AMPLIFIER TUBE IS PERFECTED FOR TELEPHONY

A new transcontinental microwave system capable of carrying four times as much information as any previous microwave system is under development at Bell Laboratories. A master key to this development is a new traveling-wave tube of large frequency bandwidth.

The traveling-wave amplifying principle was discovered in England by Dr. Rudolf Kompfner, who is now at Bell Laboratories; the fundamental theory was largely developed by Labs scientist Dr. John Pierce. Subsequently the tube has been utilized in various ways both here and abroad. At the Laboratories it has been perfected to meet the exacting performance standards of long distance telephony. And now for the first time a traveling-wave tube will go into large-scale production for use in our nation's telephone systems.

The new amplifier's tremendous bandwidth greatly simplifies the practical problem of operating and maintaining microwave communications. For example, in the proposed transcontinental system, as many as 16 different one-way radio channels will be used to transmit a capacity load of more than 11,000 conversations or 12 television programs and 2500 conversations. Formerly it would have been necessary to tune several amplifier tubes to match each channel. In contrast, a single traveling-wave tube can supply all the amplification needed for a channel. Tubes can be interchanged with only very minor adjustments.

The new amplifier is another example of how Bell Laboratories research creates new devices and new systems for telephony.



Left: A traveling-wave tube. *Right:* Tube being placed in position between the permanent magnets which focus the electron beam. The tube supplies uniform and distortionless amplification of FM signals over a 500 Mc band. It will be used to deliver an output of five watts.

BELL TELEPHONE LABORATORIES

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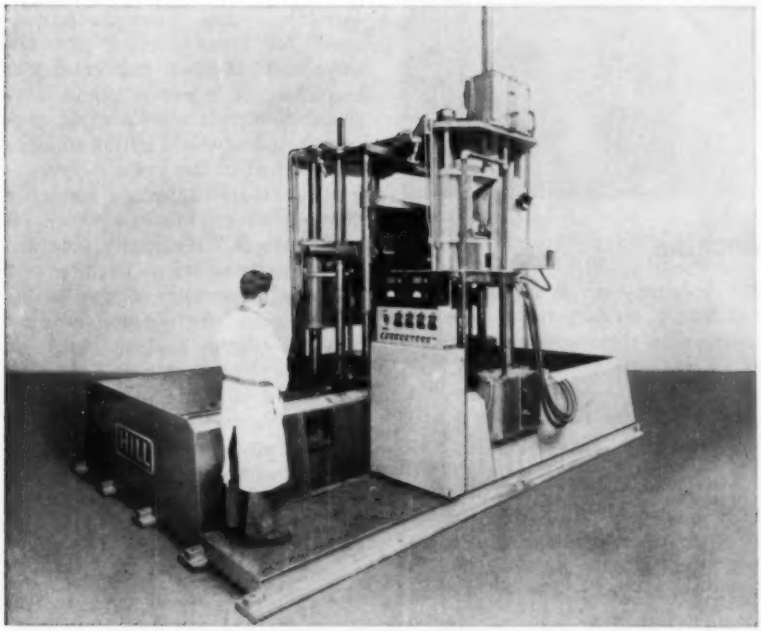

Automatic Opposed-Spindle Drilling Machine

THE CONTINUING expansion of atomic energy programs and petroleum and chemical industries has greatly increased the requirements for large condensers and heat exchangers. Largely to fulfill this need, a fully automatic, hydraulically-powered, electrically controlled drilling machine was developed by **Walter P. Hill Inc.**, 22183 Telegraph Rd., Detroit 19, Mich.

This versatile machine can handle sheets and baffles up to 6 ft diam and 10 in. thick, and produce holes at feed rates up to 18 ipm with conventional oil flute drills. Uniform, straight, round holes are produced in a single drilling operation; tube sheets and baffles can be drilled separately or stacked with assurance of accurate alignment at assembly for easy tube insertion. A positioning system controls both head and table index functions. Vertical and horizontal indexes are controlled by individual escapement wheels that are moved by shaved gears driven by racks and pinions on the table and heads. Hole spacings for different parts are obtained by inserting suitable change gears in the escapement wheel drive train.

Design and Operation

Two hydraulic power heads are mounted opposite each other. Each head travels vertically on a pair of 6 in. diam solid steel columns. The work fixture is mounted on a table having positively lubricated steel-backed bronze bearings that travel on ground ways. Hardened roller followers guide the fixture at its top during indexing and maintain alignment of the fixture with the drill heads to prevent the production of oval or barrel-shaped holes.

Individual hydraulic cylinders are used to index the heads and table. Indexing is done by automatic operation of an electrically-controlled hydraulic cylinder which releases the escapement wheel for vertical head travel. As the head index cylinders raise and lower the heads in unison, the escapement wheel is rotated to the next index position. The drilling sequence begins as each drill is fed through the sheet and retracted to complete the drilling of one hole in each of two rows. Then the table is automatically indexed to the next hole position and two more holes are drilled. A hole can be eliminated from the pattern by operating a panel control. Machine is capable of drilling 2400 holes in a 5 in. thick tube sheet in about 8 hours. This represents a 95 per cent reduction in time over conventional methods of laying out, center punching, spotting, single-drilling and reaming.

Features of the Machine

The pushbutton control panel has manual function and automatic cycle controls. Load meters on the panel back out drills automatically if hard spots or tool dulling cause overloads above a preset amount. The meters can be set to suit the optimum load conditions for a given drill size. Adequate chip capacity is included in the base of the machine. The table has a 15 ft travel to permit loading of the fixture out of the machining area by overhead crane.

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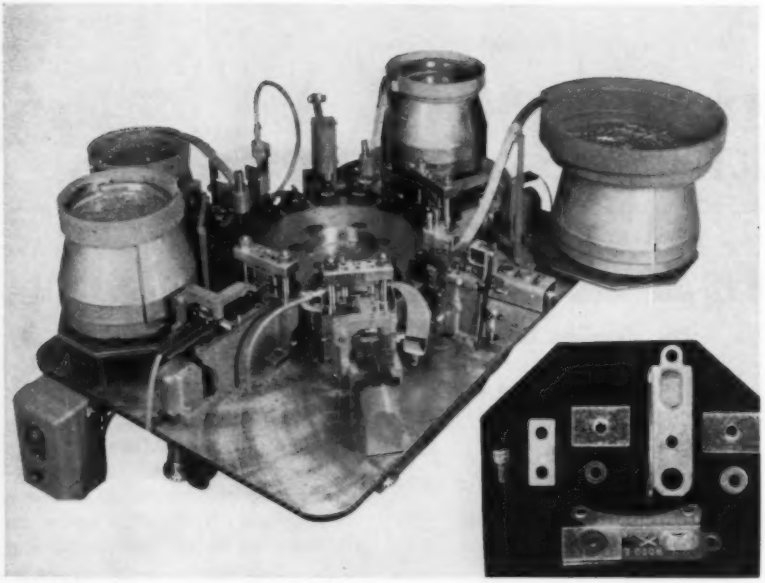

Circuit Breaker Assembly Machine

Item 402

Unit includes two cam-driven multistation indexing dials, four vibratory bowl feeders, three strip-feeding mechanisms and one cold-upset station. In operation, a contact is fed from one of the feeders into a nest in the first dial. A connector link is fed from another feeder and placed over the contact shank. Strip insulating material is fed from a reel, punched, pierced, and placed over the shank of the contact.

Synchronized with these actions, the breaker base is automatically fed into a holder and clamped in position in the second dial. Strip stock is fed, pierced, blanked, and placed into a hole in the base. A steel washer is fed from a feeder and placed on the base over a pilot. The two subassemblies are brought together, assembled, and the contact shank is cold-upset. The assembly is then automatically ejected. Production rate is 3000 assemblies per hour. **Federal Tool Engineering Co.,** 1384 Pompton Ave., Cedar Grove, N. J.

Circle 402 on Page 17

Molding Machine

Item 403

Capable of high speed jobs in the packaging industry, plastics injection molding machine has production rate of 720 cycles per hour. Model 200-H 6/8 has a 30 hp motor, full hydraulic clamp with 15-inch stroke and 25-inch daylight, which automatically adjusts for different mold thicknesses. Clamp controls are centralized; movable cams provide easy adjustment for stroke, daylight, slow-close for die contact, slow breakaway and ejection stroke. Independent clamp and injection circuits allow simultaneous traversing of both clamp and injection rams.

Injection circuit features controls for prepacking for shots 8 oz or over; flow control for plunger slowdown; dual pressure adjustment for lower holding pressure after mold is filled, and automatic unloading of injection pump. Differential circuit allows rapid prepositioning of the injection plunger at the start of the cycle. Hydraulically actuated injection assembly is mounted on phenolic shoes on guided ways. Hydraulic pressure holds nozzle on sprue bushing and provides retraction of the entire injection unit for purging or easy removal of the heating chamber. Separate pilot circuit has external pressure and pilot lines to each individual valve.

One piece heating chamber places heating bands directly on the torpedo section. Overhead oil tank incorporates oil bath air cleaner, oil level gage and thermometer and eliminates possible contamination of oil with water, material and other foreign matter. Motor starter, pyrometers, timers, relays and transformer are located in electric control panel, mounted on its own base separate from the machine. **Hydraulic Press Mfg. Co., Div. of Koehring Co.,** Mt. Gilead, Ohio.

Circle 403 on Page 17

Automatic Cradler

Item 404

Machine is capable of handling gross loads up to 6000 lb. It is designed to receive existing journal blocks, shaft, and brake or tensioning assembly. An idler roller, 5 inches in diameter, is attached to the cradle to shift in unison with the unwind roll for accurate edge guiding by this method.

Model KHWA-6 is hydraulically powered to shift 2⅝-inches lat-

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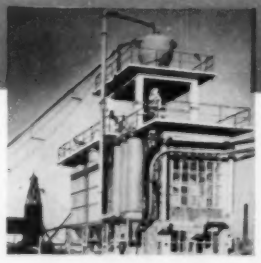

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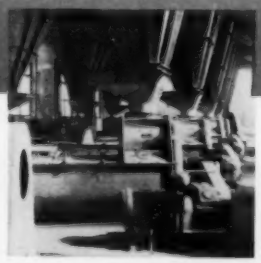

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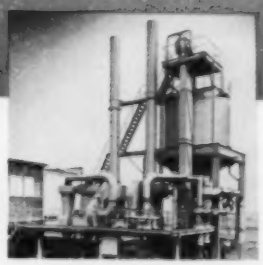

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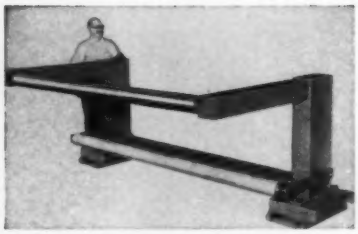

erally each way from center on 2½ inch hardened and ground steel raceways; is mounted on lateral ball bushings which are protected by seals and wipers. Uprights are also available, or mounting pads suitable for receiving the existing unwind stand would be employed whenever practical. Photograph shows one such cradle with the uprights and a second idler roller attached for a particular application requiring the two idler rollers. Normally only the lower idler roller is required. **Fife Mfg. Co. Inc.,** P. O. Box 878, Oklahoma City, Okla.

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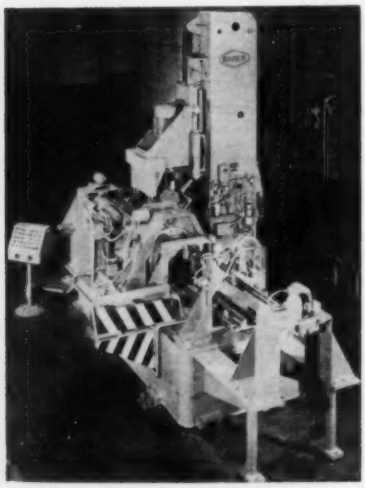

Inspection Machine

Item 405

Units check V-8 cylinder blocks before machining, to determine whether blocks have any walls that are too thin. If wall thickness cannot be maintained, the block is automatically rejected and painted for identification. When the block is acceptable, the vertical head advances and drills two manufacturing holes in the block; the head withdraws and the block is shuttled to the next position for reaming these holes. After reaming, a mechanical turn-over flips the block for additional subsequent operations. Transfer is completely mechanical through a ball nut and screw. All controls are by Cypak static switching, manufactured by Westinghouse. **Baker Brothers Inc.,** Toledo 10, Ohio.

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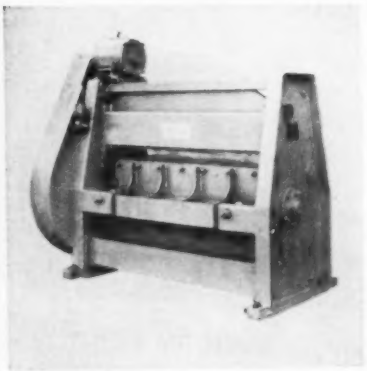

High-Speed Shear

Item 406

Device, suitable for automated lines, cuts metal sheet to specified length from coil stock. Friction clutch allows accurate control and high speed operation. Shear design allows higher conveyor speed; loop or hump in the stock can be reduced and the gage on a PM gage table can be advanced closer to the shear, allowing a shorter minimum cut. Adjustment of the knife blade clearance is quick and easy, provides a clean cut and increases knife life. **Production Machinery Corp.,** Dept. AU, 39805 Mentor Ave., Mentor, Ohio.

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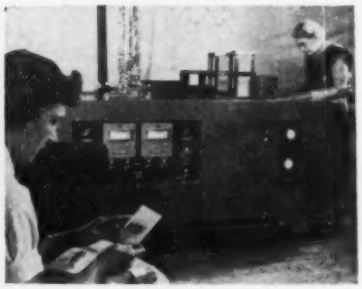


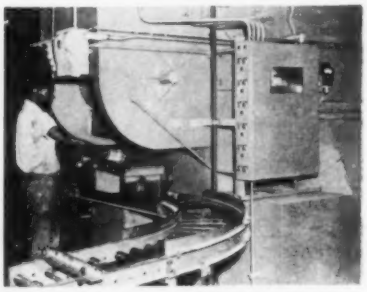
Packaging Machine

Item 407

Instrument automatically packages drug, cosmetic, food, hardware, and other items in transparent plastic blisters. Machine inserts preformed plastic blisters, loads them with merchandise, feeds a printed card, heat seals the blister to the card and ejects it. A film top can be substituted for the printed card in packaging such items as jelly and marmalade.

Controls for the entire operating cycle are constructed so that blisters of any thickness and any material can be packaged up to a maximum size of five by twenty inches. The heat sealing section is made in two banks, each with its own controls for pressure, dwell-time, and heat. Another control governs the length of time the conveyor belt stops between indexing, permitting more time for the loading of blisters where collating is necessary. Production rate is 150 units per minute of one item or 25 each per minute of as many as six items simultaneously. Celanese Corp. of America, supplier of acetate sheet provided technical assistance in developing the machine. **Packaging Industries Inc.,** Montclair, N. J.

Circle 407 on Page 17



Parts Cleaner

Item 408

Machine suitable for cleaning stampings, small castings, machine, and electrical parts. Device automatically washes, rinses, and dries screw parts coated with quenching oil and cleans the tote pans containing the screws. Drum fixtures of Model RJ-WRD are constructed so the tote pan containing the screws to be cleaned is clamped to the bottom of each fixture by a locking device. As each loaded fixture enters the washer it is slowly rotated as it passes through the washing, rinsing, and

PUTTING THE DIFFERENCE IN DIFFERENTIALS WITH

CYPAK

to speed production and cut rejects at Canadian Acme Screw & Gear, Ltd.

CYPAK* static controls do the thinking on Canadian Acme Screw & Gear's new 15-station transfer machine, producer of differential cases for automobiles . . . choose each operation in the sequence . . . signal the component stations to perform at the correct instant . . . provide maximum continuous operation with less down time, fewer rejects.

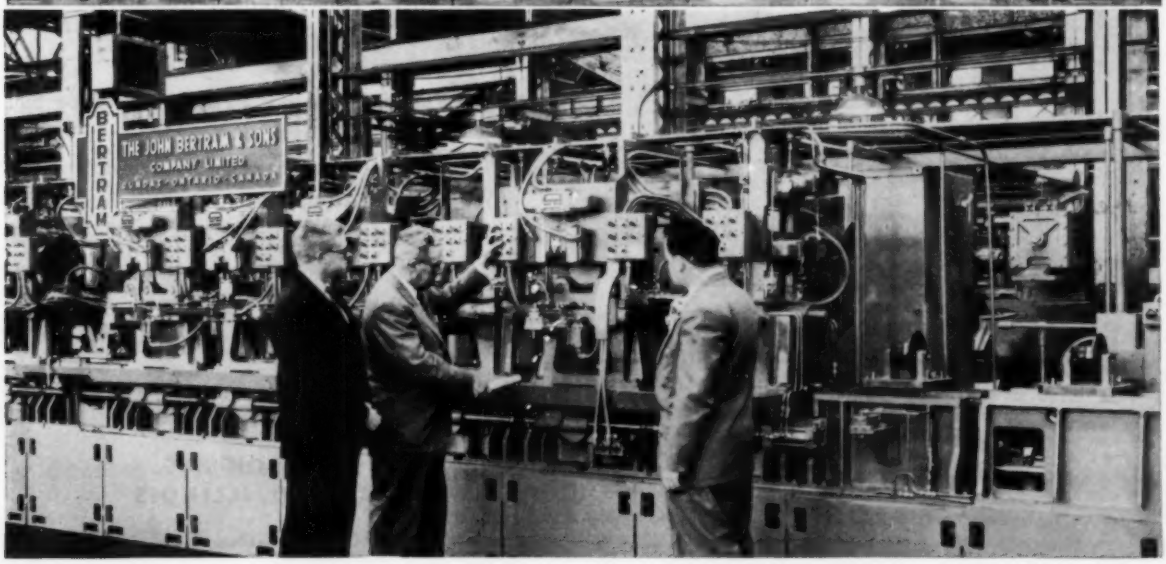
Because Cypak is completely automatic . . . has no moving parts to wear or jam, it can perform the most complicated functions faster, with no mistakes. And you can count on Cypak to give you 15 times longer operating life than conventional relay controls.

Ask your Westinghouse sales engineer for detailed information about the ways Cypak can benefit you. Or write Westinghouse Electric Corporation, Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania. J-22076

**Trade-Mark*

YOU CAN BE SURE...IF IT'S

Westinghouse



GREENLEE TRANSFER MACHINES

Change with Your Requirements

THIS MACHINE HAS BEEN REWORKED FOUR TIMES

The "building block" idea of machine tool design has gained much popularity in recent years. Greenlee has long built such flexibility into their transfer machines. For example, the machine shown here has been modified 4 times in 11 years to accommodate changes in product design. Protect yourself from costly obsolescence. Ask Greenlee to show you how.

PHONE ROCKFORD, ILLINOIS 3-4881
TO HELP SOLVE YOUR PRODUCTION PROBLEMS

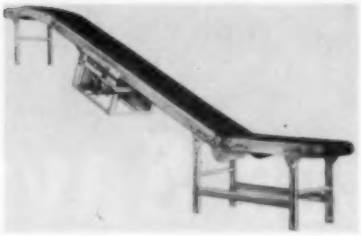
GREENLEE BROS. & CO.

2091 MASON AVE.
ROCKFORD, ILLINOIS

Circle 681 on Page 17

drying cycles. When heavier work items are processed the drum fixture is gently rocked instead of rotated to prevent nicking of parts. Chemicals can be added to the rinse to protect parts with a rust inhibitor. **Industrial Systems Co.**, Matawan 1, N. J.

Circle 408 on Page 17

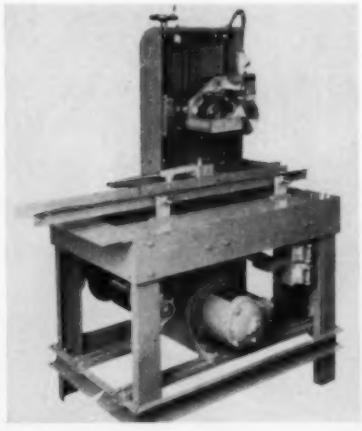


Belt Conveyor Lines

Item 409

Components include roller and slider beds; end drive unit; a combination center drive and take-up unit; slider and roller bed vertical curves; an end take-up unit and a loading section for incline conveyors. Components can be easily bolted together and assembled in many combinations. Belts are available in 12, 18, and 24-inch widths with friction surfaced, Neoprene-impregnated, solid woven cotton or rough top belting. **Conveyor Specialty Co. Inc.**, 33 Newport Ave., N. Quincy 71, Mass.

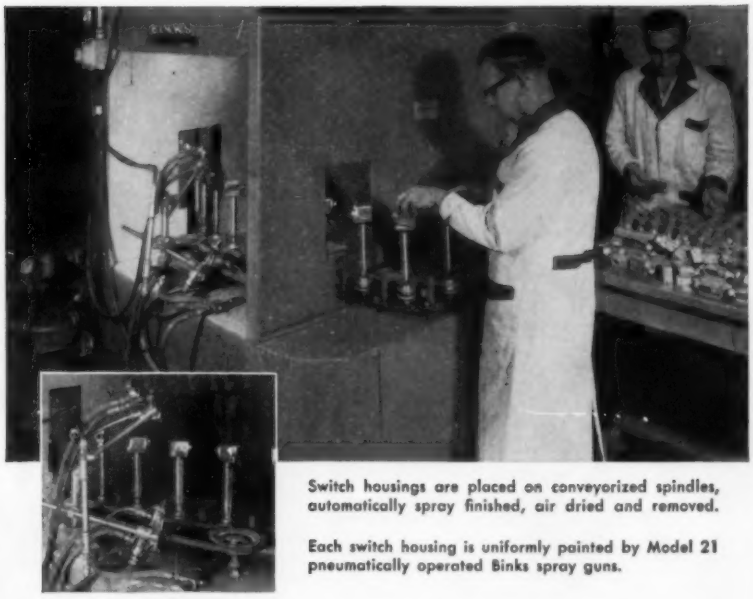
Circle 409 on Page 17



Package Printer

Item 410

Designed for imprinting or trademarking bricks, the package



Switch housings are placed on conveyorized spindles, automatically spray finished, air dried and removed.

Each switch housing is uniformly painted by Model 21 pneumatically operated Binks spray guns.

At MICRO SWITCH...

automatic painting on Binks machine boosts finishing output 400%

"We are now able to paint up to 945 switch housings an hour," reports Mr. Walter Gage, finishing foreman for the MICRO SWITCH division of Minneapolis Honeywell Regulator Company, Freeport, Ill. "This is four times our previous hand spraying rate and we use one-third the manpower."

Fast, uniform finishing

Switch housings are placed on conveyorized spindles which rotate as they pass through the spray booth. Binks pneumatically operated Model 21 automatic spray guns apply a uniform coating on all surfaces as each spindle passes.

Engineering help available

Working with your engineers and production people, Binks spray finishing engineers can help you cut costs...boost production...improve quality. Because Binks line of spray finishing equipment is so complete, they need not compromise in the selection of any part of a finishing system. The "right" equipment combination for your every production need, is always available.

For complete information

Contact your nearest Binks Branch Office or write direct to the address below.

Ask about our spray painting school
Open to all...NO TUITION...covers all phases.

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EVERYTHING FOR
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SPRAY GUNS

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Binks Manufacturing Company
3132-40 Carroll Ave., Chicago 12, Ill.

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Circle 682 on Page 17

At Massey-Harris-Ferguson

Natcos Save 100 Parts...

Three multiple-spindle Natcos bore, drill, spotface and tap the front end support for a Massey-Harris-Ferguson tractor

NATCO

60 Man Hours Every

on Rugged Axle Support Castings

Massey-Harris-Ferguson checked it two ways. Nine general-purpose machines would do the job—or 3 Natcos. They chose the Natcos for these reasons:

- *Saving of $30,000 in machine cost*
- *Saving of 60 man hours every 100 parts*
- *Saving of 65% in floor space*

The Natcos handle all drilling, boring, spotfacing and tapping—a total of 67 operations on the 182-pound front axle casting. The casting is heavy, irregular—tough to fixture and clamp. The Natcos meet production requirement of 11 parts per hour.

Natco provided complete tooling which features automatic clamping, cycling and chip blow-out. All three machines are of unitized construction, giving Massey-Harris-Ferguson the flexibility to run different parts of redesigns of the same part.

Let Natco Field Engineers point out cost-saving and time-saving methods on your next drilling, boring, facing or tapping job. Natco offices are located in Chicago, Detroit, New York, Buffalo, Boston, Philadelphia, Cleveland and Los Angeles; distributors in other cities.

National Automatic Tool Company, Inc.

Richmond, Indiana

Multiple-spindle drilling, boring, facing and tapping machines. Special way-type, index and transfer machines.

Circle 693 on Page 17

High Speed Production Lines Demand...

SAVINGS WITH FULLY-AUTOMATIC, AGITATING DIP-CLEANING METHODS!

Modern, automatic, high-speed production lines demand modern automatic cleaning machines which can be fully integrated in the overall operation . . . and Magnus makes them.

The Magnus Aja Lif Automatic Cleaning Machine shown above is used by a major bearing manufacturer to remove grinding grease from bearing races. Parts are automatically agitated in each of the stages of pre-wash, wash, rinse and anti-rust and, automatically transferred from one stage to the next on a pre-set time schedule.

The result . . ? Since replacing his old vapor degreaser with the automatic Magnus Aja Lif and the Magnus buffing compound remover, Magnus #71, this manufacturer has realized savings of thousands of dollars per year without the hazards of solvent cleaning.

For information on how you too can realize greater efficiency in production-line cleaning from Magnus machines, materials and methods, write today. Write Magnus, 101A South Avenue, Garwood, New Jersey.

magnus

Industrial Cleaning Division

MAGNUS CHEMICAL CO., INC.

a world-wide organization specializing in cleaning and protection of all surfaces

printer is also suitable for marking, dating, coding or identifying any square or oblong package. Model 602 uses an aniline printing system, has an adjustable printing head and an ink reservoir which holds several hours supply. Production rate is up to 60 units per minute.

An explosion-proof motor or controls for specific requirements are also available. **Industrial Marking Equipment Co. Inc.**, 454 Baltic St., Brooklyn 17, N. Y.

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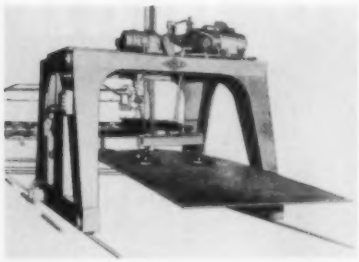


Plate Handler

Item 411

Designed to pile, transport and deliver sheet or plate stock to shears, presses, cleaning or polishing machines, plate handlers can also be used to restack material from a machine, or to transfer stock between conveyors and piles. Vacuum lift permits handling of almost any type of sheet or plate stock such as ferrous or nonferrous metals; plastics, plywood, and hardboard without marring polished or finished surfaces. Protective coatings do not interfere with its operation.

Vacuum is supplied by a built-in heavy duty piston type industrial pump, operating through an interlocked system that prevents lifting until safe vacuum is built up. The handler automatically contacts the top sheet of a pile as it diminishes, without adjustment. Controls permit preselected pickup from either of two piles or conveyor locations. A floor-rail mounted gantry transports the material to the shear or machine feed rolls, ball points or feed table and deposits it in position. **Noble Co.**, 1860 Seventh St., Oakland 20, Calif.

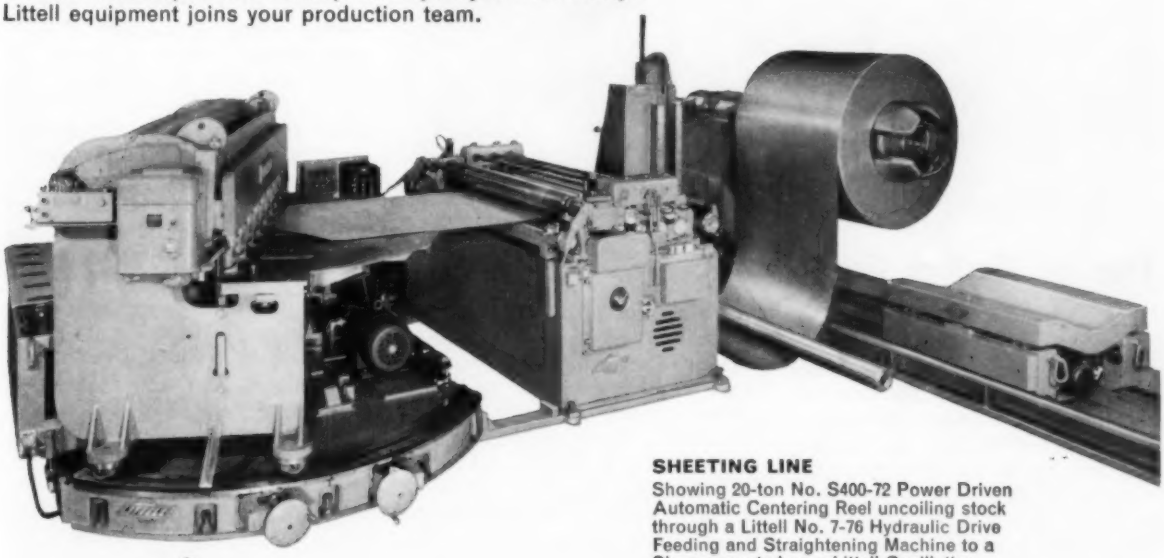
Circle 411 on Page 17

LITTELL

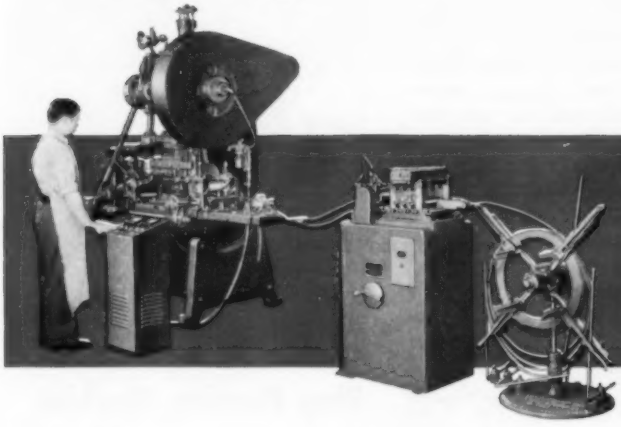
THE COMPLETE COIL HANDLING LINE

PERFORMANCE PROVED FOR 39 YEARS

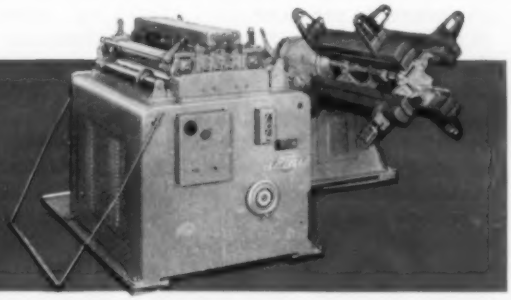
Whether you use coil stock .010" thin, or .187" thick, Littell builds the straightener you need. Whether you require a reel of 300-pound or 40,000-pound capacity, Littell builds it. Not only is Littell the most complete line, it is the **only** line in the field with a service record that goes back 39 years, to the first coil stock. All this experience works profitably for you when today's Littell equipment joins your production team.



SHEETING LINE
Showing 20-ton No. S400-72 Power Driven Automatic Centering Reel uncoiling stock through a Littell No. 7-76 Hydraulic Drive Feeding and Straightening Machine to a Shear mounted on a Littell Oscillating Shear Base.



COIL TO STAMPING
Showing No. 3G Littell Automatic Centering Reel with 300 lb. coil capacity, No. 308 Littell Variable Speed, Power Driven Straightener; and Press equipped with Littell No. 3 Double Roll Feed.



STRAIGHTENER-REEL
This combination Variable Speed Straightening Machine and Automatic Centering Reel comes mounted on a common base, pre-aligned. 7 Straightener Rolls, 2.25" x 38"; 2 Pinch Rolls, 4.25" x 38". 5 h.p., 4 to 1 Variable Speed Drive provides any speed from 225" to 900" per minute. Electric Brake Reel handles 6,000 lbs. coils up to 36" wide. No. 436-7PD-S60.

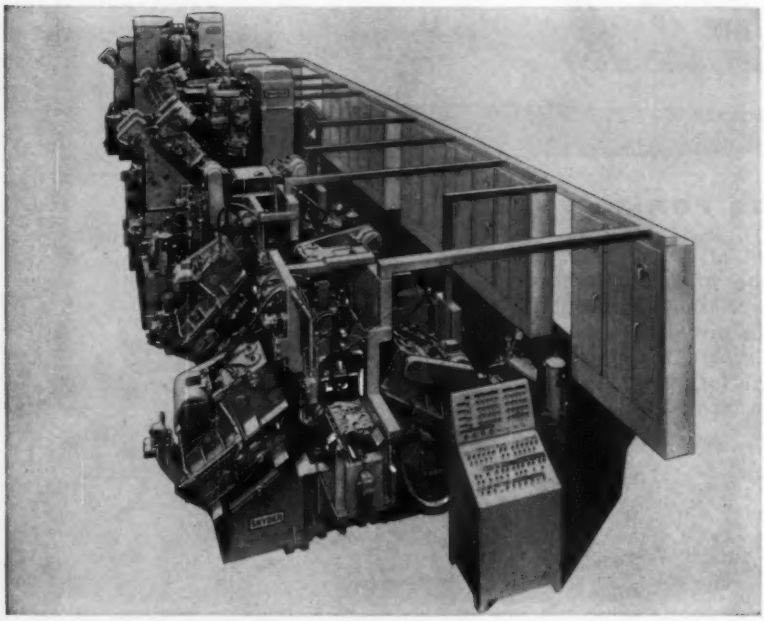
F. J. LITTELL MACHINE CO.
Speed with Safety

ROLL FEEDS • REELS • STRAIGHTENING AND FEEDING MACHINES • COIL CRADLES • SHEETING LINES
District Offices: Detroit, Cleveland

4105 Ravenswood Ave. Chicago 13, Ill.

LITTELL CATALOG 56
gives full details.
Write for free copy.

Circle 685 on Page 17



Transfer Machine Line

Item 412

Line designed to machine automotive engine intake manifolds complete from rough casting to finished part. Two or four-barrel carburetor manifolds can be fed into the line at random. Built-in sensing devices automatically shift heads at three stations to provide the required machining operations. No idle stations are necessary to permit the processing of the two different parts. Production rate is 136 manifolds per hour.

The first two transfer machines perform milling operations. Rough castings are fed to each of the machines into a loading station and are transferred to the second station where they are automatically equalized and clamped. When the cover face has been rough milled the manifold is automatically turned over. Subsequently it is transferred from station-to-station on this machined surface. Following a series of drilling and tapping operations, the manifolds are turned over again and the cover face is finish-milled. Then the carburetor pads are rough and finish-milled. When mounting holes are drilled for the carburetor, push rod clearance is milled, and the drilled holes are automatically probed with gaging devices that shut down the machine if any holes are incomplete.

Another series of drilling, probing, reaming and tapping operations are performed to complete the machining of the manifolds in the third transfer machine. At one of the tapping stations in this machine, drilling and tapping heads are automatically shifted according to the two or four-barrel carburetor mounting surface hole requirements. **Synder Tool & Engineering Co.**, 3400 E. Lafayette, Detroit 7, Mich.

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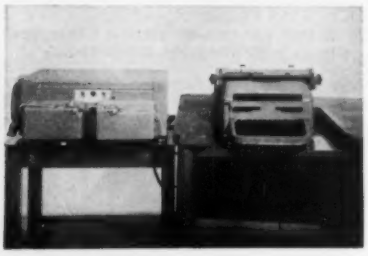

Punched Tape Typewriter

Item 413

Machine is applicable in business activities including purchase order writing, accounts payable, salary and factory payrolls, production orders, account records, transportation freight billing and waybilling. Machine automatically punches and reads the paper tape that activates other equipment and wire communications systems. As an ordinary electric typewriter in preparing source documents, it automatically translates that which is typed into a punched tape. When a punched tape is fed into it, the machine automatically reads and types out the information at the rate of 120 wpm.

The operator can punch a *stop* code into the tape so when the tape is later read, the reading unit will automatically stop to permit a manual insertion of variable data. When a letter is typed followed by a figure, the machine automatically accommodates the switch from alphabetical to numeric code-holes in preparing its tape. The typewriter unifies remote work stations, and speeds input and output to and from a centralized processing system. It is available in three models; a tape punching unit, a tape reading unit, and a unit that does both. **Remington Rand, Div. of Sperry Rand Corp.**, 315 Fourth Ave., New York 10, N. Y.

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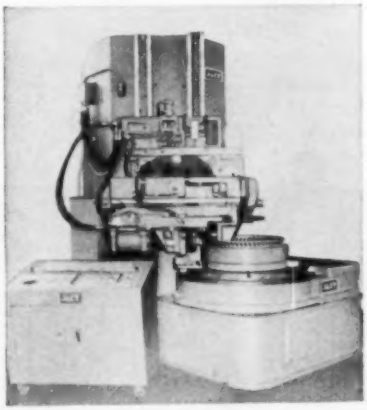

Ring Piercing Machine

Item 414

Device perforates or forms annular rings varying in size from 16 to 54 inches in diameter. Unit combines an index table and a precision machine tool for accurate repetitive positioning of dies to ten-thousandths of an inch. The index table has automatic and manual control with a solid mechanical lock with zero backlash in all posi-

MANSFIELD, OHIO, KNOWS *CCC

Yes, Mansfield is well aware of Commercial Contracting Corporation's team of specialists. That's the town where CCC installed the presses and machine tools in the nation's largest stamping plant. These heavy presses are turning out body stampings for America's major builder of motor cars.

CCC won the job through experience in installing automated equipment . . . for world leaders in the production of steel, aluminum and automobiles.

Industrialists all across America know that CCC is prominent in important plant installations of the post-war expansion era. They rely on the talents and techniques, the experienced supervision and precise organizing that CCC brings to every job. If your company is planning the removal, relocation or installation of machinery, turn the job over to CCC. Your project will be completed *quickly, economically* and *efficiently*.

CCC services, individually or under one Package Contract, include: Press Erecting • Rolling Mill Installation • Machinery Installation and Moving • Foundry Installations • Overhead Crane Installation • Mothballing.

Write for new illustrated brochure.

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Circle 686 on Page 17

tions. Absence of cams, change gears, etc. decreases handling, storing, and set-up time. The table is available as a self-contained unit and is suitable as a base for machining operations such as drilling, boring, milling and broaching. **Modern Engineering Service Co.,** 2695 W. 12 Mile Rd., Berkley, Mich.

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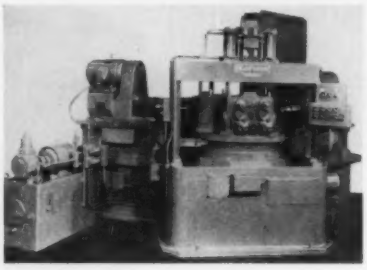

Boring Machine

Item 415

Device performs multiple operations on automotive body rear band servos. Two parts are loaded on the machine, and the *Clamp, Start-Cycle* button is pressed. The machine indexes to the next station where both parts are rough bored, grooved, and an angle is formed. At the next station, the part is finish bored to± 0.0005-inch. The entire operation is controlled from one electrical pushbutton panel located at the front of the machine. Production rate is 220 pieces per hour. **Olofsson Corp.,** 2732 Lyons Ave., Lansing, Mich.

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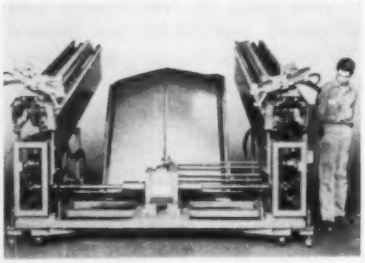

Press Unloader

Item 416

Portable, plug-in packaged unit has two mechanical jaw assemblies mounted on individual carriages. The carriages are advanced and retracted by a reversible air motor through a roller chain drive. A built-in electrical control system allows the unit to be timed as desired. Unloader unit is adaptable to various stamping designs; jaw assemblies swivel in any plane and the carriage slides have vertical and angular adjustment.

Unit operates on 20 to 45 psi air line pressure. To unload a stamping, the jaws extend and grip the part when the press opens; the carriages retract; and at the end of the carriage travel the jaws retract and release the part, dropping it into a standard turnover unit. The carriage advances to initial position for the unloading of the next part. **Press Automation Systems Inc.,** 25418 Ryan Rd., Centerline, Mich.

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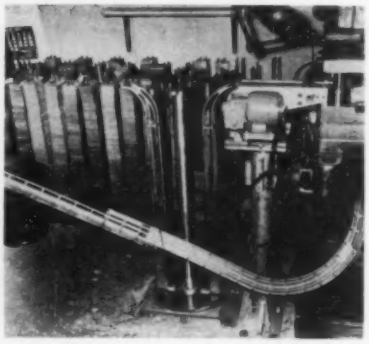

Stacking Chutes

Item 417

Suited for electrical and electronic equipment manufacturers, chutes are capable of carrying and stacking stampings up to 20 ft away from the presses. Stampings that are springy, small, thin, delicate or complicated are automatically transported from the presses to packaging or assembly lines without damage to the product or the dies.

Chutes are made from high carbon cold rolled rods. Rings or plates are machined to maintain exact dimensions throughout the chute and are brazed to the rods with high tensile nickel silver. The chutes can withstand the shock of vibration of press operation and insure a maximum load capacity up to 5000 lb. Chutes are mounted onto the die shoe of the press bolster and are adaptable to all types of open back inclinable presses, high production presses and dieing machines. **Clark Industries,** Delaware, Ohio.

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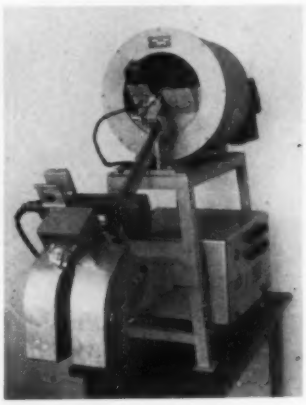


Bench Hopper

Item 418

Unit suitable for packaging a variety of parts such as nuts, bolts, screws, rivets, dowels, buttons, candies, pharmaceuticals, plastic parts, and toy parts. Change over time from one size or shape to another is five or ten minutes.

Hopper consists of a rotary drum with cast-in pockets which collect a quantity of parts and carry them up to the orienting chute. A stationary retainer plate gradually closes the pocket as the hopper revolves, capturing the collected items. At the peak of the turn, the retainer plate ends, releasing the parts onto the discharge track where they are oriented and counted. The tracks and orienting wheel are adjustable for various items and the pick-up pockets are universal for all times. The flow of parts is continuous. Any count from 1 to 1000 can be obtained by setting dials on the predetermined electronic counter. A small bench stand houses the electronic instrument and has a large funnel housing that can accommodate screws up to 3 inches in length. Production rate is up to 200,000 counts per hour, depending upon the item being counted. **U. S. Engineering Co.,** 40-28 22nd St., Long Island City, N. Y.

Circle 418 on Page 17

How to increase production with new tool control methods proved at Ford's Sterling Plant

Scully-Jones "TOOLITROL" System

reduces tool costs and downtime on vital transfer lines

At the Sterling Chassis Parts Plant of Ford Motor Company, Sterling Township, Mich., cutting tools are changed *in groups*, rather than individually, with Scully-Jones "Toolitrol" boards and presetting tools performing the following functions:

1. Preset counters in the panel signal the tool-changers when each cutting tool in the machines reaches its optimum number of cuts.
2. Presetting tools at the board make it easy to adjust one set of sharpened tools in holders to exact depth while another set is producing in the machines.
3. Presetting tools and preset cutting tools with holders are stored in the "Toolitrol" panel, clearly identified by station and spindle.

A fast team method of tool-changing takes maximum advantage of the "Toolitrol" system. A tool-changer and setup man are assigned to each transfer line—a total of six men. Nine other jobsetters form a pool from which teams of men are drawn to quickly change *groups* of tools on any one of three lines. When the "Toolitrol" light signals that any one tool has reached maximum life between sharpenings, counters for other tools are checked, and all tools *closely approaching* the change period are changed at once. Thus, the total *number of downtime periods is greatly reduced*. At the same time, sharpened, preset tools from the "Toolitrol" panel are quickly and easily inserted in the machine—*reducing the length of each downtime period.*

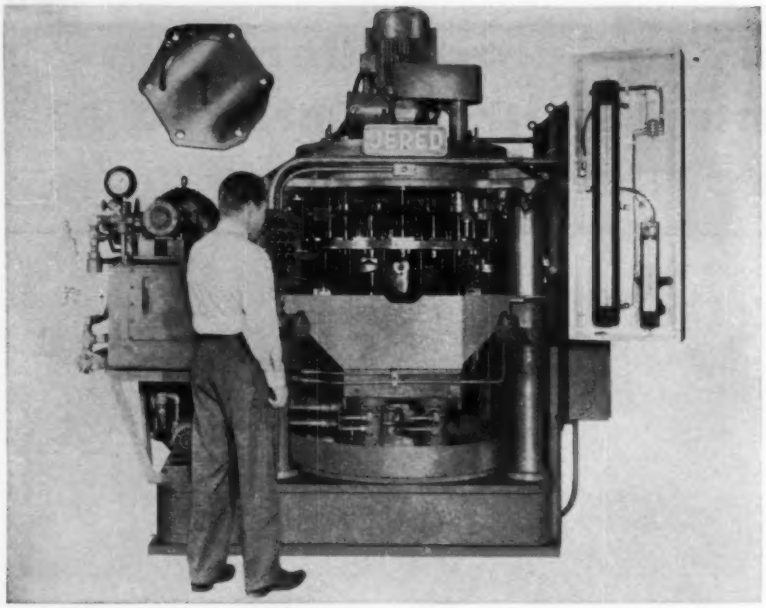
Ask your Scully-Jones representative about a free showing of: "Down with Downtime and Up with Production."

SCULLY JONES

PRECISION HOLDING TOOLS

"Precision Holding" for holding precision

SCULLY-JONES AND COMPANY, 1930 SOUTH ROCKWELL ST., CHICAGO 8, ILL.



Vacuum Pump Tester

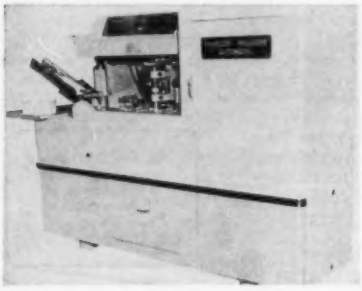
Item 419

Instrument for testing windshield wiper vacuum pumps for passenger cars, trucks, buses, tractors, boats, trains, planes or other moving vehicles. Tester is a 16 station, self-contained machine with automatic lubrication throughout. The performance test is a series of 3 checks—2 vacuum checks and 1 torque check in a one minute test of each pump.

The first vacuum check is a static check, to prove the pump is capable of pulling a minimum of 26-inches of mercury. The second vacuum check is a flow check, to prove the pump, with a displacement of 0.2 cubic feet per minute of free air, will pull 6-inches of mercury. The torque check proves that the internal, rotational resistance of the pump does not exceed 4-inch lb of torque, at 20 rpm. The net results of each test are recorded on a memory system, visible at the unclamp station, immediately in front of the operator.

Except for loading and unloading, all operations are automatic. The pumps are automatically clamped and unclamped; indexed, and handled throughout the testing. A safety feature is that the automatic clamping fixture will not close until the hands of the operator have been removed from the area. **Jered Industries Inc.**, 2323 E. Nine Mile Rd., Hazel Park, Mich.

Circle 419 on Page 17



Film Mounter

Item 420

Unit designed for high speed, automatic mounting of microfilms of engineering drawings, insurance records and other large volume documents. Mounter takes the microfilm from reels and unitizes it by mounting individual frames to apertures in punched cards or ordinary file cards; processes either negative or positive microfilm reels, in lengths from 100 to 1000 ft.

An automatic detection system immediately stops the mounter when any one of the operational stations fail because of card imperfection, film not meeting specifications, error in either film or card sequence, equipment failure, or operator error. The machine shuts off at a point where the card can easily be removed, checked and a new card inserted or the error corrected. In its film-to-aperture mounting the units protective glassine is stripped from the card aperture; the film is advanced with an electronic scanner controlling pull-down to within ten thousandths of an inch of accuracy; cut and sealed to card frame, and an accurate count is made of film frames and cards. **Filmsort Div., Dexter Folder Co.**, Pearl River, N. Y.

Circle 420 on Page 17

Remote Weight Recorder

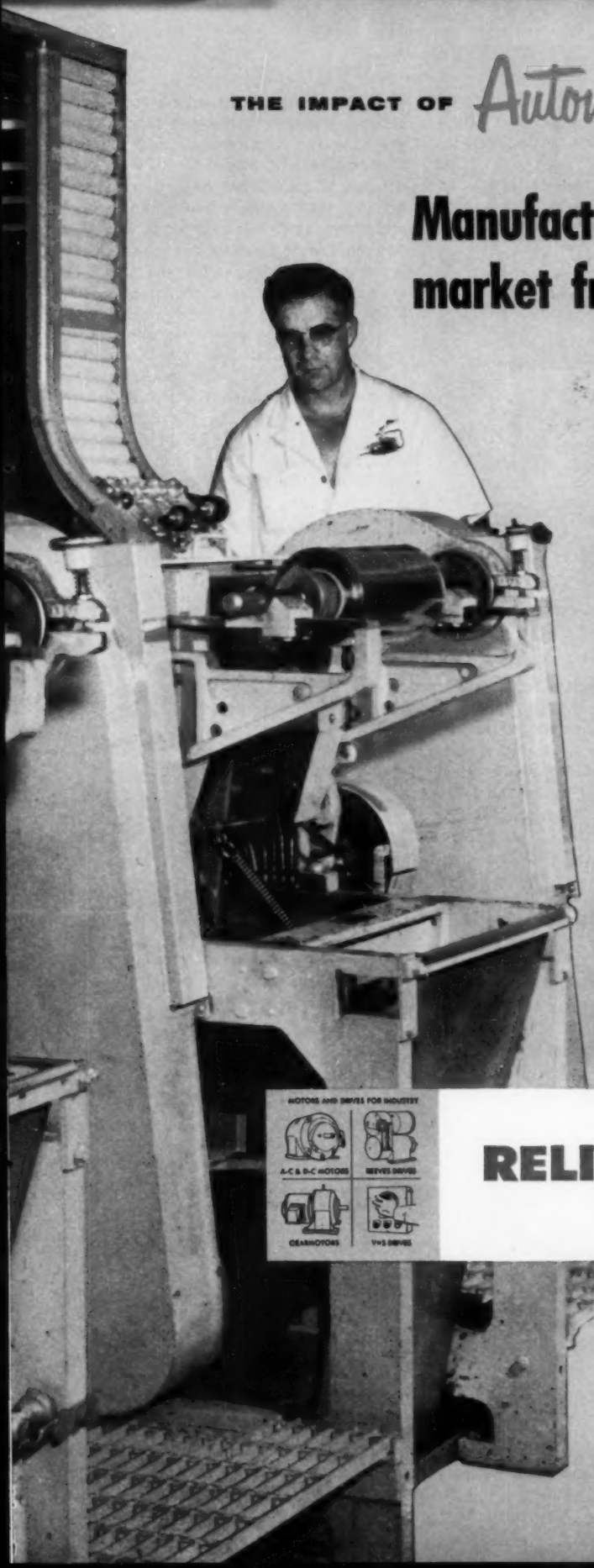
Item 421

Control console can be remotely located from the weighing point, in an office or any location at distances up to 1000 ft. Machine consists of a control panel and a cabinet for housing control elements of the weighing system with a location for the listing and adding unit which records weight data originating at the remotely located scale. Pilot lights allow operator to follow the operation through all its stages.

The number of cycles can be preset allowing system to operate through this number automatically. As each cycle is completed, the number is recorded on the digital indicator so that it is possible to see the number of weighing operations completed at any

THE IMPACT OF *Automation* ON TODAY'S BUSINESS

Manufacturer builds million dollar market from last night's leftovers



This is the success story of a chemical company and a new household product that had to be produced economically for a highly competitive market. The market is the budget-minded homemaker and the product is Saran Wrap—the plastic film your wife uses to keep leftovers fresh. High speed production equipment was needed to produce it in large volumes with a minimum of hand work.

So the manufacturer used automation . . . a very special kind.

As a result, this transparent wrap has become an economical household necessity, increasing the manufacturer's sales volume, and creating new jobs and stockholder investment opportunities.

HORSEPOWER FOR AUTOMATION BY RELIANCE

This machine is automatically winding household-size rolls of Saran Wrap...a job that requires an exact number of turns to a roll, fast starts and stops, and precise tension control.

A Reliance V*S Drive handles the problem. The Reliance Motor supplies fast, smooth acceleration and deceleration. Reliance automatically controls a cycling operation with split-second timing.

Reliance V*S Drives are designed for automatic operation, whether it's one machine or a complete production line. To find out how V*S Drives fit into your automation picture write for Bulletin A-1555-B "Widening the Horizons of Automation." (D-1555)

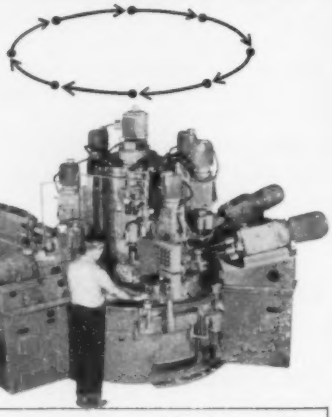
RELIANCE ELECTRIC
AND ENGINEERING COMPANY

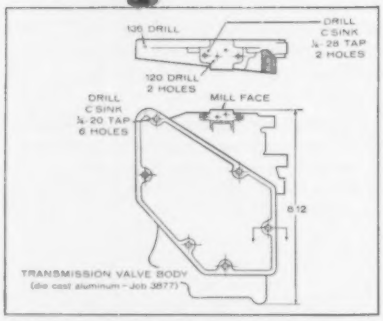
Dept. 2611A, Cleveland 17, O. • Canadian Division: Welland, Ont.
Sales Offices and Distributors in Principal Cities

Circle 688 on Page 17

- drills
- c'sinks
- taps
- mills

460 PER HOUR GROSS




.136 DRILL
DRILL C'SINK ¼-28 TAP 2 HOLES
.120 DRILL 2 HOLES
DRILL C'SINK ¼-20 TAP 6 HOLES
MILL FACE
TRANSMISSION VALVE BODY
(die cast aluminum - Job 3877)

Here's a central column Kingsbury with a 60-inch index table, six vertical units mounted on the central column, three angular and one horizontal. Part is tipped in fixture so milling is horizontal. Vertical units work on the holes in milled face, angular units on the six mounting holes. Operator loads part, presses two buttons to clamp work; two more to index table; two more to unclamp work for removal.

The idea behind this Kingsbury, like all other Kingsburys, is high hourly output in automatic, unvarying cycles — for low unit cost and quick pay-off. May we propose a Kingsbury for your work? Kingsbury Machine Tool Corporation, Keene, New Hampshire.

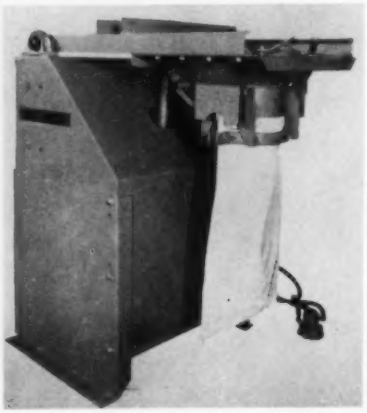
KINGSBURY

INDEXING AUTOMATICS for high production drilling and tapping

Circle 689 on Page 17

time. A total or subtotal of weights can be obtained by a push-button. **Toledo Scale Co.,** Toledo, Ohio.

Circle 421 on Page 17

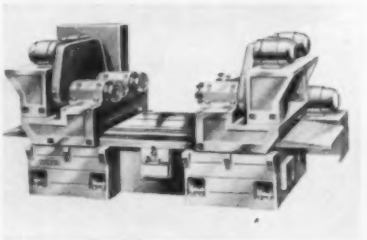


Bag Packer

Item 422

Unit bounces as it packs, is suitable for packing burlap, cotton, and jute bags. An operator attaches the bags to an air-operated, foot-controlled bag holder while the packer is stopped. When the foot pedal is released, bag clamps lock the bag to the spout and the packer jounces material into the bag. After the material is tightly packed, the operator presses the pedal to drop the bag onto a conveyor or sewing belt. The scale cannot discharge with the bag holder open. Production rate for Model G-73 is twelve 100 lb bags a minute. **Richardson Scale Co.,** Van Houten Ave., Clifton, N. J.

Circle 422 on Page 17



Boring Machine

Item 423

Units are larger than other standard models and capable of performing operations such as precision boring, turning, facing, grooving and chamfering, singly or in combination. Model 2440 is a double-end machine having two bridges that support the spindles and drive equipment. Bridges are 54 inches wide to allow for mounting a number of spindles and can be spread apart to accommodate large workpieces or moved close together for fast operating cycles on smaller parts. The maximum length of stroke of the table is 40 inches, and table fixture pad dimensions are 28 by 46 inches. A single-end unit, Model 1440, is identical to the 2440 but has only one bridge. **Ex-Cell-O Corp.,** 1200 Oakman Blvd., Detroit 32, Mich.

Circle 423 on Page 17

Straight Presses

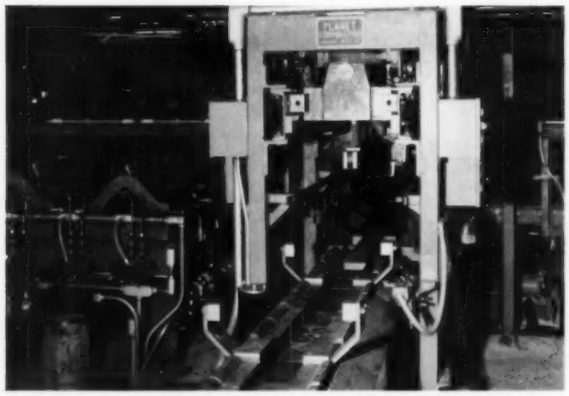
Item 424

Adaptable for blanking rubber and vinyl floor tile, custom built presses provide fast and efficient production when set up with automatic equipment. Press can be operated under full power at any part of the stroke length, without jamming or damaging machines. Four, round guides with adjustable bronze bushings act the same as a leader pin in a die shoe. Relays, solenoids, etc. are mounted in the control cabinet. Limit switches are actuated by adjustable stops. Selector switch allows jogging, inching, or cycling with either control buttons or foot switch. **Superior Machine Co.,** 1389 Heistan Place, Memphis 4, Tenn.

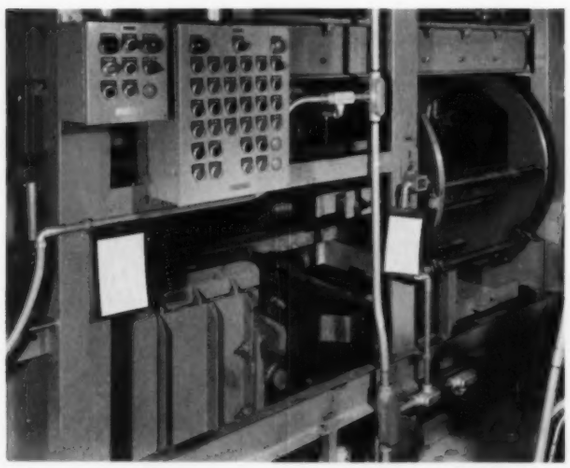
Circle 424 on Page 17

Circle 690 on Page 17→

Shown above is the automatic conveyor loader, or transfer unit. This unit uses an air cylinder pusher bar to remove the engine blocks from the production line conveyor to the flat-top, slat type conveyor with outrigger arms. This conveyor returns from below the floor of the plant.

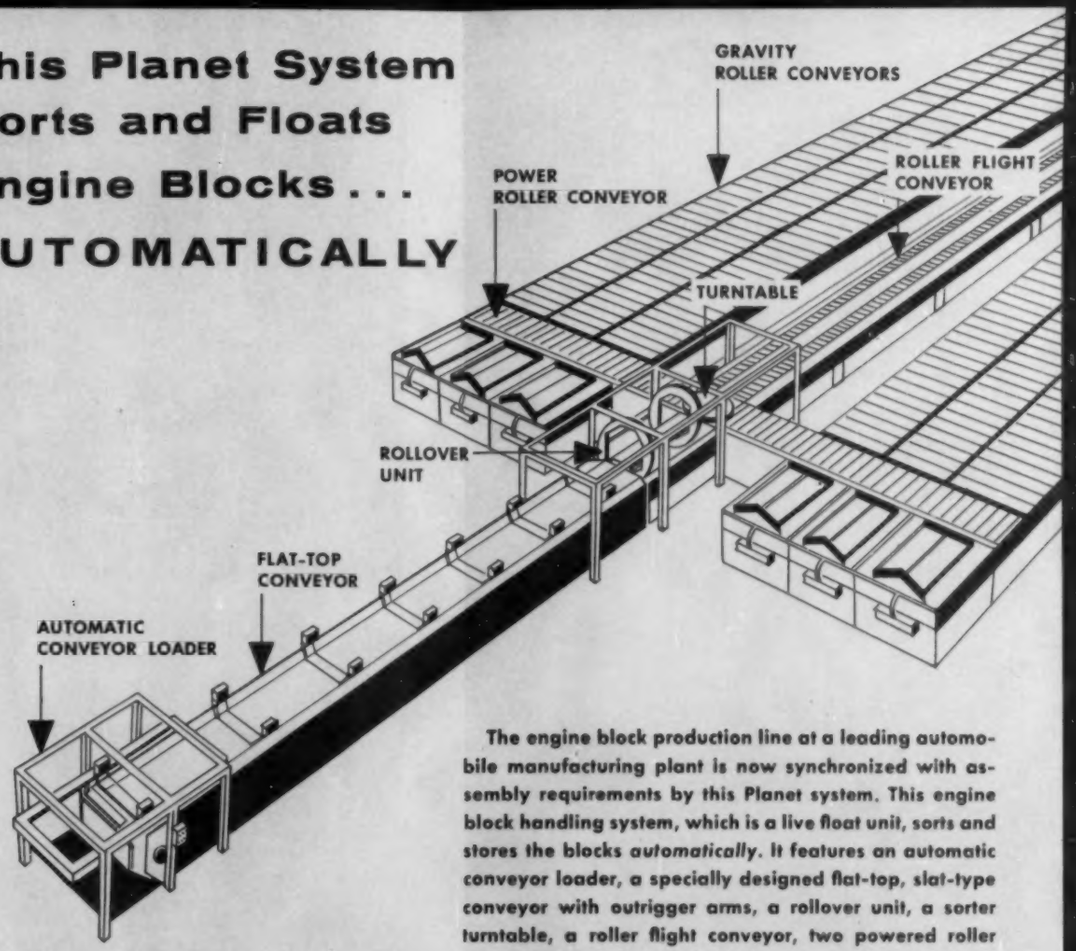


The flat-top conveyor, which has outrigger arms (above, foreground) that support the engine flywheel housing, carries the blocks to the rollover unit. The length of this conveyor provides space for inspection and minor "pick-up" assembly operations.

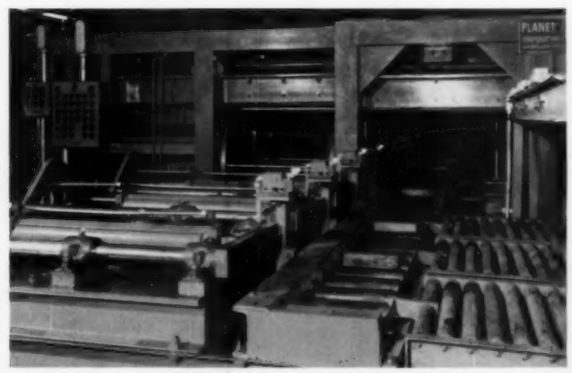


From the flat-top conveyor, the blocks are pushed into the rollover unit by an air cylinder. This 360 degree rollover operation eliminates nuts, scrap, etc. that may have fallen into the blocks during production. They are then pushed by another air cylinder onto the 90 degree turntable.

This Planet System Sorts and Floats Engine Blocks . . . AUTOMATICALLY



The engine block production line at a leading automobile manufacturing plant is now synchronized with assembly requirements by this Planet system. This engine block handling system, which is a live float unit, sorts and stores the blocks *automatically*. It features an automatic conveyor loader, a specially designed flat-top, slat-type conveyor with outrigger arms, a rollover unit, a sorter turntable, a roller flight conveyor, two powered roller conveyors and six gravity roller conveyors for storage.



After the blocks have been turned, they normally flow directly onto the powered roller flight conveyor where they are picked up for transfer to final assembly. However, if this conveyor is full, the blocks are automatically pushed by an air cylinder onto one of the powered roller conveyors for movement to one of the six gravity roller storage conveyors. The blocks are pushed onto one of these conveyors by another air cylinder. As a storage conveyor is filled a mechanical stop is activated to start the blocks loading another storage conveyor. This entire operation is controlled automatically by limit switches.

IT PAYS TO PLAN WITH PLANET

A completely engineered system is often the only effective solution to a production, materials handling or automation problem. In such systems every unit must be matched and carefully integrated. Small details of design make the difference between a smoothly operating system and one that is a constant source of trouble.

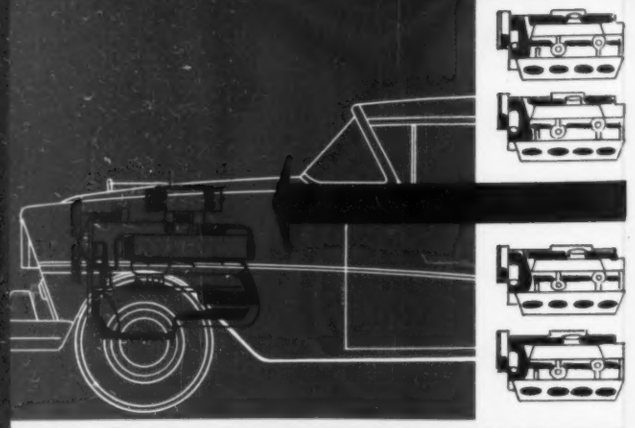
Planet Corporation is staffed with completely qualified and experienced graduate engineers. They give your problem painstaking attention from preliminary surveys, engineering and design to installation and field testing.

Let Planet demonstrate how its know-how and experience can help you to solve your problem. It will pay you to "Plan With Planet." Write or phone today — there's no obligation, of course.

PLANET CORPORATION

- ENGINEERED HANDLING SYSTEMS
- AUTOMATION EQUIPMENT
- FOUNDRY HANDLING EQUIPMENT

1810 SUNSET AVENUE LANSING, MICHIGAN



PLANET DESIGNED SYSTEM BALANCES PRODUCTION LINE

A leading automobile manufacturer had a problem . . . engine block production was running ahead of assembly requirements. One of two things could be done: (1) Slow down the engine block production line, or (2) Install a system to float the excess production until needed.

The first solution was discarded as inefficient and too costly. Then, Planet engineers were called in to help design, fabricate and install an efficient live storage system.

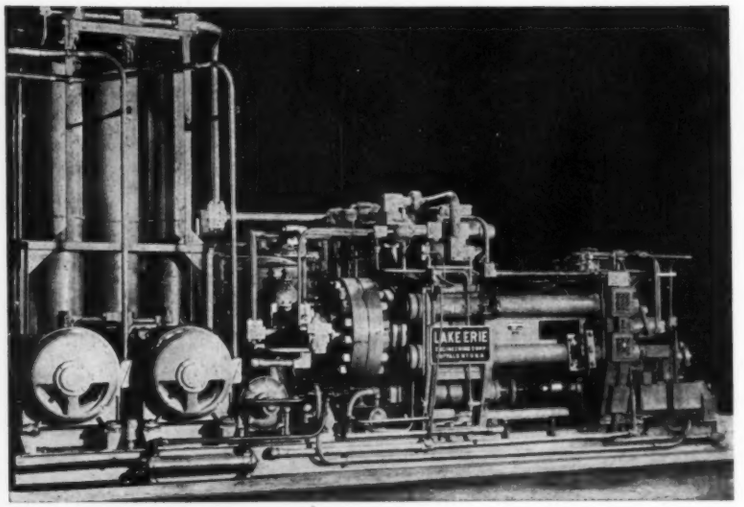
From that moment on, Planet engineers combined systematic, logical procedure with creative engineering to find the best and most economical solution described under this flap.

If your plant has a production, material handling, or automation problem, Planet know-how and experience can help you. It paid this manufacturer to "Plan With Planet" — it will pay you too. Write or phone today — there's no obligation, of course.

PLANET CORPORATION

• ENGINEERED HANDLING SYSTEMS
• AUTOMATION EQUIPMENT
• FOUNDRY HANDLING EQUIPMENT

1810 SUNSET AVENUE LANSING, MICHIGAN



Automatic Cold Extruder

Item 425

Unit extrudes automobile torsion bar anchor housings from 1035 steel at a rate of 525 per hour. Concentricity is held to 0.010-inch total indicator reading. Automatic cycling in connection with a special 5-station patented dial feed results in the high production rate. The dial has two movements, axial and rotary. A hydraulic cylinder moves the dial axially to clear the fixed tools during indexing. Each time a billet is extruded, a new one is fed into a dial station and an extruded billet is stripped from the die. Press is rated at 440 tons extrusion and 44 tons ejection pressure. Unit is approximately 24 ft long, has 51-inch daylight opening and 18-inch main ram stroke. Approach speed is 1200 inches per minute; extrusion speed is 500 inches per minute at 2550 psi. **Lake Erie Machinery Corp.**, 727 Woodward Ave., Buffalo, N. Y.

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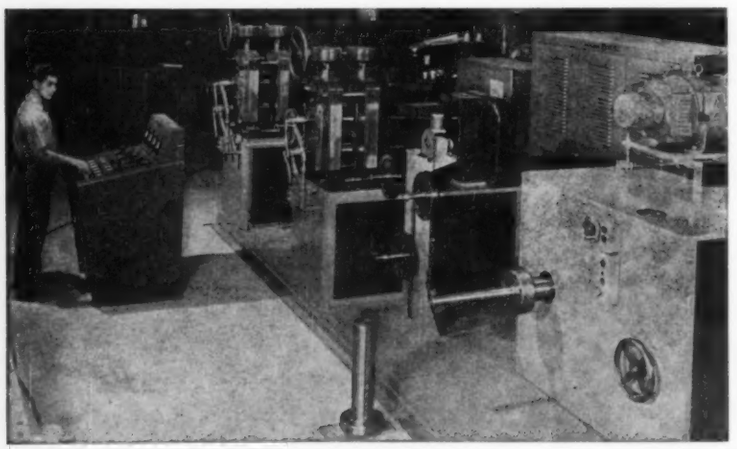


Wire Flattening Mill

Item 426

Designed for high speed operation while holding close tolerances, device is suitable for items such as flat wire springs, hair springs, electronic tube components, bookbinding materials, resistance elements, slide fasteners and staples. Machine consists of two mill stands, equipped with 8 by 5 inch rolls, faced with cemented tungsten carbide rings. A welded structural steel base carries the mill stands, two dancer roll mechanisms and a traversing recoiler. The mill is capable of producing strip in thicknesses ranging from 0.010-inch up and in widths to ⅝-inch. Clutch device is fitted to the horizontal screwdown shaft for rapid correction of roll parallelism.

Tungsten carbide sleeves are fitted to the mill rolls for better surface finish and closer size tolerances. Close width tolerances are maintained by a quick release vertical edging unit mounted on the entry side of the second mill stand. Both mill motors receive their power from a single generator. A manually operated potentiometer accelerates and decelerates all motors together as a unit. Horsepower can be altered to suit individual requirements. When processing relatively light wire gages, synchronization between the roll stand and recoiler is obtained by the dancer roll mechanisms. When flattening heavier sizes of wire the dancer roll stands are by-passed and the vernier rheostats are set manually. Recoiler is synchronized electrically for constant tension and winds coils of various sizes with a maximum weight of 500 lb.

Unit is available with a circulating system for the roll neck bearings, a strip coolant system, continuous gaging equipment to measure both thickness and width of the material, a die holder and oiler mounted on the entry side of the first mill stand and a cone type pay-off stand equipped with a snarl switch. **Stanat Manufacturing Co. Inc.**, 500 Shames Dr., Westbury, N. Y.

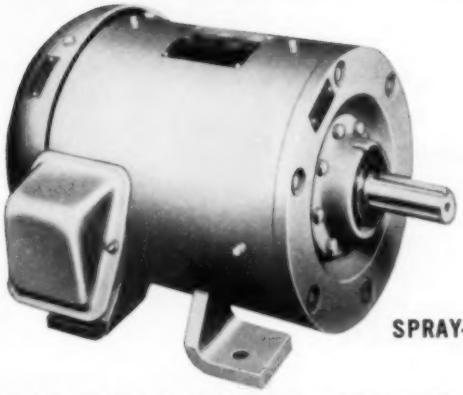
Circle 426 on Page 17

Vacuum Filter

Item 427

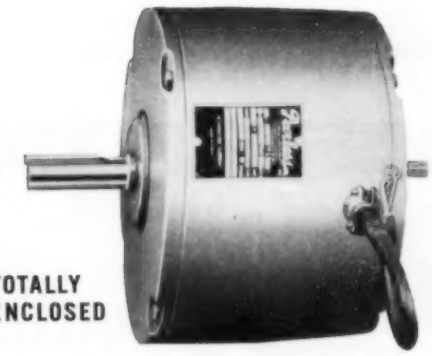
Device designed for the filtration of grinding coolants and cutting oils. Filtration is accomplished by tubular screen elements manifolded into a suction header box in which a vacuum equivalent

ONLY ONE MOTOR IS RIGHT FOR YOUR APPLICATION...



SPRAY-TIGHT

Fan cooled; 7½ HP; Navy; Hi-shock to Navy Spec. MIL-M-17060A.



TOTALLY ENCLOSED

Blower and Drive Motor; 4 HP; air drawn over motor.

SPECIAL CONSTRUCTION

Motor to fit customer's application design.

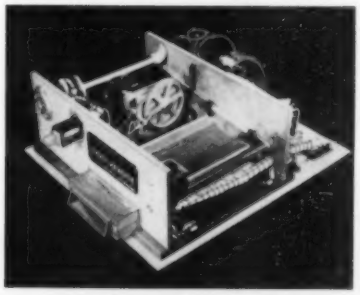
STANDARD EXPLOSION-PROOF MOTOR

1 to 30 HP; also with NEMA C face and NEMA D flange.

● One thing's certain—just one motor is right for your application. Design engineers turn to Peerless more often than ever today because Peerless is equipped to produce the motors that power their machines best. There's no need to fit the machine to the motor. Peerless has hundreds of motor designs—many of them created specifically to meet OEM problems. Give your next motor problem to the Peerless Representative near you or write directly to the factory. We'll work with you to develop the one motor that meets your needs best.

Electric Motor Division

PUNCHED CARD READERS
for IBM and Remington cards



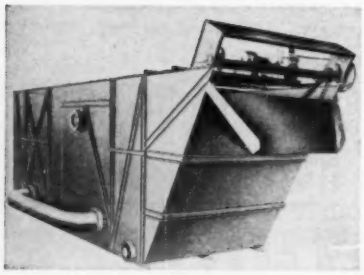
Write for Bulletin CR-7

Electronics Division

THE *Peerless-Electric*® COMPANY

FANS · BLOWERS · MOTORS · ELECTRONIC EQUIPMENT

1512 W. MARKET ST. · WARREN, OHIO



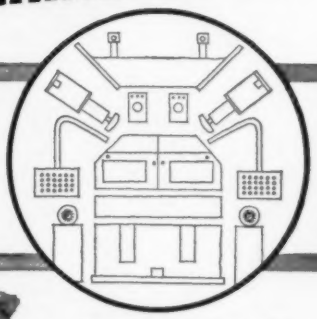
to 18 inches of mercury is maintained. Self-cleaning in this Delpark Filter-Matic is done by a float activated limit switch which energizes an air valve and cylinder and reverses the coolant flow through the manifold into the tubes knocking off the filtered deposits held on the periphery of the tubular screens. Sediment from the screens is removed by chain-driven flights which deposit the sludge in a tote box for disposal. The flow of coolant to or from the filter is not interrupted during the cleaning cycle. **Industrial Filtration Co.,** Dept. FMH-471, Lebanon, Ind.

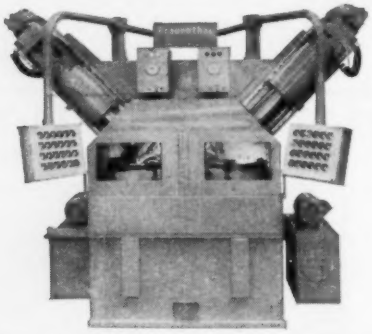
Circle 427 on Page 17

SIMPLE AS ABC...

the STANDARD BUILDING BLOCK TECHNIQUE OF MACHINE DESIGN

FORD wanted a machine to finish grind in excess of 100 impeller housings and 100 covers an hour. Frauenthal Division—Kaydon was given the job.





They put the machine together "building block" style... AND SPECIFIED TWO STANDARD SUPER PRECISION SPINDLES. The machine is working right now... turning out 138 pieces an hour on each side, at 80% efficiency.

Standard's new catalogues on Spindles, Slides and Feeds is a handbook of special machine components... with complete working drawings, dimensions and capacities. WRITE FOR YOURS TODAY!

America's most complete line of super precision spindles; also slides, feeds and tables. Spindles — motor driven and independent drive — 1/4 H.P. to 200 H.P.

SUPER PRECISION SPINDLE DIVISION

the STANDARD electrical tool co. SINCE 1912

STANDARD SETS THE PACE!

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Booth 1641
Metal Show
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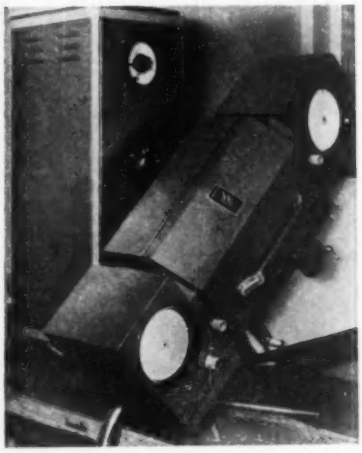


Spectrographic Analyzer

Item 428

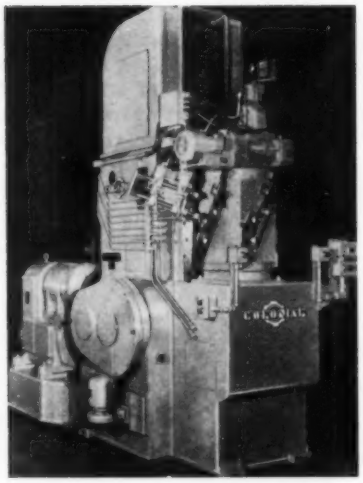
Unit is suitable in every field covered by spectrochemical instruments using photographic plates. It permits measurement of instantaneous values, and gives direct reading of analysis. The Spectro-Lecteur system includes two photomultipliers; one views the line of the basic metal in the alloy; the other travels automatically along the focal plane of the spectrum, stopping at selected lines for a predetermined length of time. This allows a continuous measurement of instantaneous values of the intensity ratio between the recorded lines and the line of the basic metal.

The intensity ratio of two lines is recorded continuously on a chart, according to the element's own period of stability. The output of the two photomultipliers is fed to two identical amplification channels. Each channel comprises a preamplifier, main amplifier, band filter, rectifier, time constant network, and a milliammeter for the direct reading of the output. Signal amplification is based on the use of a spark modulation type of excitation, allowing the use of ac amplifiers throughout. Thus, drift and the need for frequent adjustments are minimized.

Device permits analysis of pure aluminum for traces as low as 0.003 per cent of Fe, Si and Cu. Features

of the unit are: changeover time from one type of alloy to another one with a different base metal is under two minutes; changeover time from direct reading to photographic process is only a few seconds; continuous recording in direct connection with the source assures an accurate, permanent record of analyses; and the use of only two electronic circuits minimizes breakdowns. **Intercontinental Electronics Corp.**, 1551 Franklin Ave., Mineola, N. Y.

Circle 428 on Page 17



Broaching Setup

Item 429

Machine automatically broaches eight oil-groove slots in an automotive rocker-arm shaft at a rate of 640 per hour at 80 per cent efficiency. Parts are broached on a 10-ton, 160-inch stroke, vertical-chain surface broaching machine equipped with a four-station indexing fixture. Shafts are manually loaded two at a time, automatically probed for true position, broached, and automatically ejected in a cycle time of 9 seconds.

Shafts are loaded in a retaining fixture on the indexing face. The part is supported on pins in conjunction with a spring loaded plunger. Positive holding action is accomplished at the cycle start by automatic clamping of two hydraulically operated wedges. At the first indexing station both parts are probed for correct hole locations by hydraulically operated probe units. When improper

if you're using special fasteners...

...you should be using APEX SOCKETS

Typical Apex nut setter and sockets designed for use with special high-speed, resilient fasteners. Note recesses in outer walls to accommodate fastener prongs; integral magnets to help speed assembly. Openings near drive ends of sockets serve to dispel minute particles from rubber seals on fasteners.

Today's assembly techniques frequently require special types of fasteners. On one assembly line, speed may be the important factor . . . on another, a resilient fastener may be needed to protect brittle or highly-finished components . . . still another may require a self-locking or vibration-proof fastener.

Each application creates its own problem to be solved with a special fastener. And each special fastener can be run down—quickly, smoothly, economically—with an Apex socket specifically designed for the job.

Apex, where special nut running problems are solved every day, has the answer to your fastening problem, routine or special. In our Catalog 29-R, you'll find over 5,000 types and sizes of standard nut running tools and a frequently-repeated note that reads, "We quote promptly on specials." Write, on your company letterhead please, for your copy.

APEX

THE APEX MACHINE & TOOL COMPANY
1036 S. Patterson Blvd • Dayton 2, Ohio

ATLANTA • BALTIMORE • BATON ROUGE • BIRMINGHAM • BUFFALO • CHARLOTTE
CHICAGO • CLEVELAND • COLUMBUS (Newark) • DALLAS • DAVENPORT • DENVER
DETROIT • HOUSTON • INDIANAPOLIS • KANSAS CITY • LOS ANGELES • LOUISVILLE
MEMPHIS • MILWAUKEE • MINNEAPOLIS • NEW ORLEANS • NEW YORK CITY • OAKLAND
PHILADELPHIA • PITTSBURGH • PROVIDENCE • ROCKFORD • ST. LOUIS • SEATTLE
SHREVEPORT • SOUTH BEND • SYRACUSE • WICHITA

Circle 693 on Page 17

positioning occurs, the machine automatically shuts off until the part is repositioned.

At the broaching station, eight oil grooves on both of the two parts are broached in one pass at a speed of 35 fpm. Grooves are angularly cut at 30 degrees to a depth of 0.06 inches. Parts are automatically unloaded at the next station by air ejection. **Colonial Broach & Machine Co.**, 21601 Hoover Rd., Detroit 13, Mich.

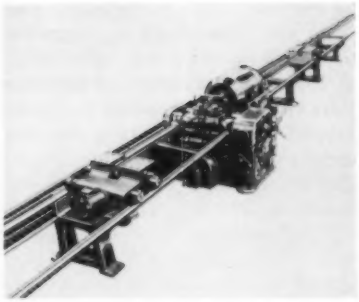
Circle 429 on Page 17

Bar Turning Machine

Item 430

Device capable of rough and precision turning of ferrous and nonferrous bars, including bars of titanium, uranium and other modern metals. Ovality tolerances of ± 0.00025 inches and a maximum limit of diameter variation of ± 0.001 inch, in any 20 ft length of bar is achieved for precision turned bars.

Bar turners can be arranged for



semi-automatic or fully automatic operation; are fitted with a wide variation of feeds for either rough or precision turning by changing cutter heads. Main drive is a variable speed motor. Shafts and gears are roller bearing equipped and gears are set in a continuous oil bath. Control of gripping and movement of the traverse carriage can be by pushbutton and the machines can be equipped with automatic bar loading and unloading mechanisms for straightline production. **Sutton Engineering Co.**, First National Bank Bldg., Pittsburgh 22, Pa.

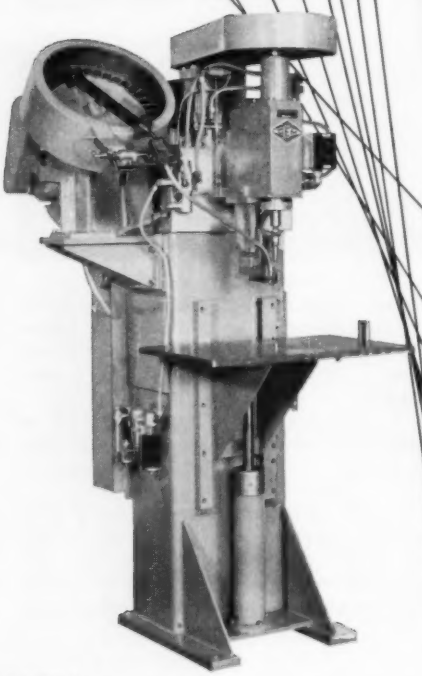
Circle 430 on Page 17

speed up your stud setting

with GRAY

heavy duty stud driving

MACHINE



Model STD-1

This rugged, new machine can give up to 630 lbs. in. of driving torque, according to the motor used.

- Drives: standard studs up to ⅝ in. dia.; Schweppe self-tapping studs and Tap-Lok inserts
- Has screw-on or self-opening drivers
- Available with single or multiple spindles
- Up to 3 hp spindle drive
- Air-hydraulic spindle feed
- Up to 1000 cycles per hour
- Studs automatically hopper fed
- Easily retooled for other applications

Write for Bulletin STD-1 and suggestions for engineering this versatile machine to your work. Gray can do the whole job for you.

GRAY EQUIPMENT COMPANY

Automatic Assembly Equipment

13600 Ford Road • Dearborn, Michigan • Telephone: TIffany 6-7573

Loaders/Unloaders

Item 431

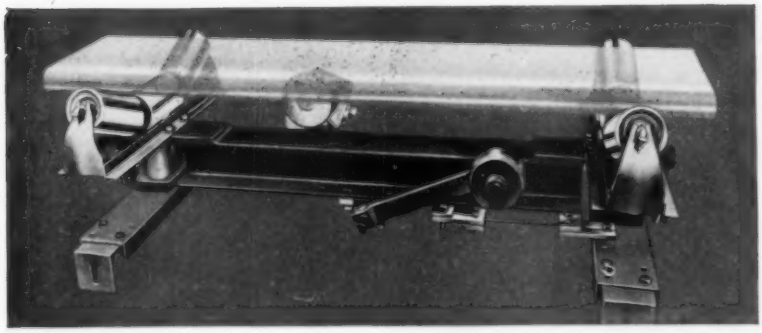
Unit designed for use with company's automatic heat treating units. A primary pusher bar, activated by parallel chains, moves the work tray forward off the roller platform. A secondary pusher bar advances the work tray into its desired position. The chain driven mechanism then retracts, and is ready for the next cycle.

Unloaders reverse the loading

Weigh it on the run ...with electronics

There are no labor costs to be charged against weighing when you incorporate a Fairbanks-Morse electronic scale in your belt conveyor system. The belt will be moving anyway, and might as well be accumulating the record of passing weight in the process.

Because it is electronic, the registering instrument of the new Fairbanks-Morse Electronic Belt Conveyor Scale can be located remotely—for instance in the office with the rest of your business and accounting machinery.



Accumulated weights are read on the remote instrument in digital figures, and there are other indicators to give you a running check on the general efficiency of your conveyor operation. A meter shows percentage of load at the given moment; another shows the rate of tonnage movement per hour.

There's a new bulletin, No. ED-12, on the Fairbanks-Morse Electronic Belt Conveyor Scale. Please write for it today. Fairbanks, Morse & Co., Dept. A-11, 600 South Michigan Avenue, Chicago 5, Illinois.

FAIRBANKS-MORSE

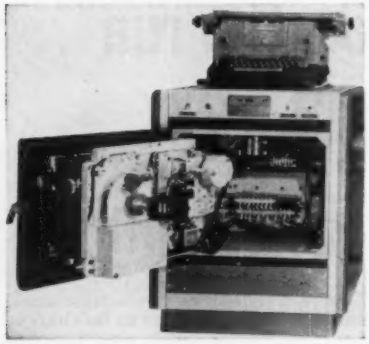
a name worth remembering when you want the BEST

SCALES • PUMPS • DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY • RAIL CARS • HOME WATER SERVICE EQUIPMENT • MAGNETOS

Circle 695 on Page 17

action by extending grab-bars through the open discharge door, automatically grasping the work tray, bringing it out of the chamber into position on the roller platform. Both units are available for stationary mounting or can be equipped with free running or motor driven wheels-on-track for transverse servicing of a number of furnaces, washers or related accessories. **Ipsen Industries Inc.,** 721 S. Main St., Rockford, Ill.

Circle 431 on Page 17



Data Logger

Item 432

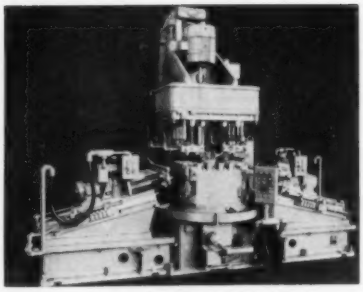
Capable of recording data in process industries, laboratories, and testing facilities, instrument will sequentially log up to 50 analog variables, continuously, on demand or at timed intervals. Data can be presented in tabular form on a typewriter, or on punched cards for further processing. Unit can record the outputs of strain gages, thermocouples, resistance bulbs, pressure transmitters, flow meters, tachometers and all other standard transducers. Optional features include high and low limit alarms, red print-out of off-limit variables, digital printing timer and thermocouple linearizing and cold end compensation. **Hanson-Gorrill-Brian Inc.,** 85 Hazel St., Glen Cove, N. Y.

Circle 432 on Page 17

Drilling Machine

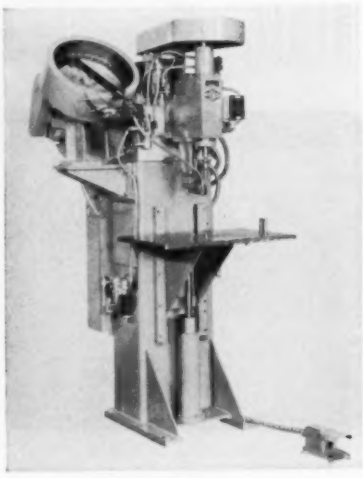
Item 433

Combination of two multiple-spindle drillers is capable of completing 756 valve rocker arms per hour. Unit is made up of a vertical Holesteel machine and a 3-way Natco (shown). Holesteel machine has 16 spindles and a 6-position automatic indexing fixture. Four parts are clamped hydraulically at each position as the major hole in each part is core drilled, rough reamed and semi-finish reamed. Parts are automatically ejected.



Natco unit consists of a vertical head with 12 spindles and two angular heads with four spindles each. Four-position automatic indexing table holds 4 parts at each position. Two holes are drilled through in two steps and one is finish-bottomed. Hydraulic distributor insures constant clamping pressure at working stations while parts are loaded or unloaded. **National Automatic Tool Co. Inc.,** Richmond, Ind.

Circle 433 on Page 17

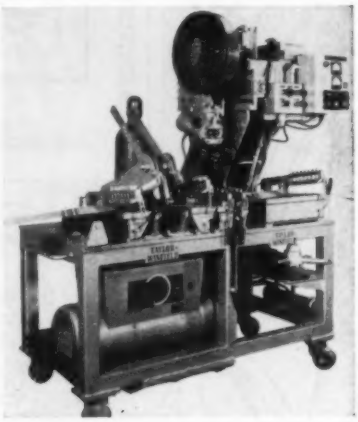


Stud Driving Unit

Item 434

Capable of setting inserts and studs in cylinder heads and crankcases on die-cast aluminum engines and with other die castings, heavy duty stud driving machine can give up to 630 in lb of driving torque. Capacity of the machine ranges up to 1000 cycles per hour with studs automatically hopper fed. Model STD-1 is available with single or multiple spindles, equipped with up to 3 hp spindle drive and has air-hydraulic spindle feed. It will drive standard studs of up to $\frac{5}{8}$ in diameter, Schweppe self-tapping studs and Tap-Lok inserts. **Gray Equipment Co.,** 13600 Ford Rd., Dearborn, Mich.

Circle 434 on Page 17



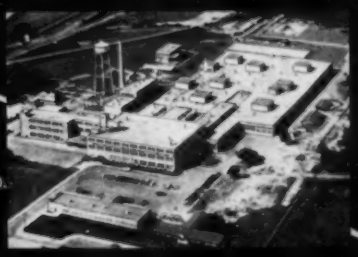
Arc Welder

Item 435

Unit can arc weld ferrous or non-ferrous metals for continuous strip operations, joining almost any type to metal that is in strip form. In operation, the tail of the expended strip is stopped, clamped, sheared to get a square edge, and moved to welding position. The front end of the next coil is treated in the same manner and the material is ready to weld.

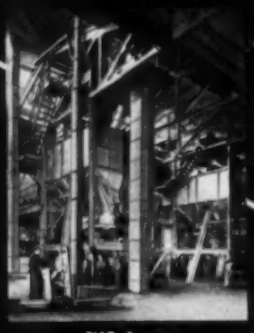
The arc welding head is automatically moved along the work at the correct speed by a motor driven screw. After welding, the clamps are manually lifted. After disc grinding the top surface, the strip may be advanced to the succeeding operations in the line. Each clamp is split into eight individually adjustable segments, giving uniform clamping pressure over the entire width of the stock. **Taylor - Winfield Corp.,** Warren, Ohio.

Circle 435 on Page 17



THE GENERAL TIRE & RUBBER CO.
WACO, TEXAS

CIA. BRASILEIRA DE MATERIAL FERROVIARIO
(Cobrasma)
SAO PAULO, BRAZIL



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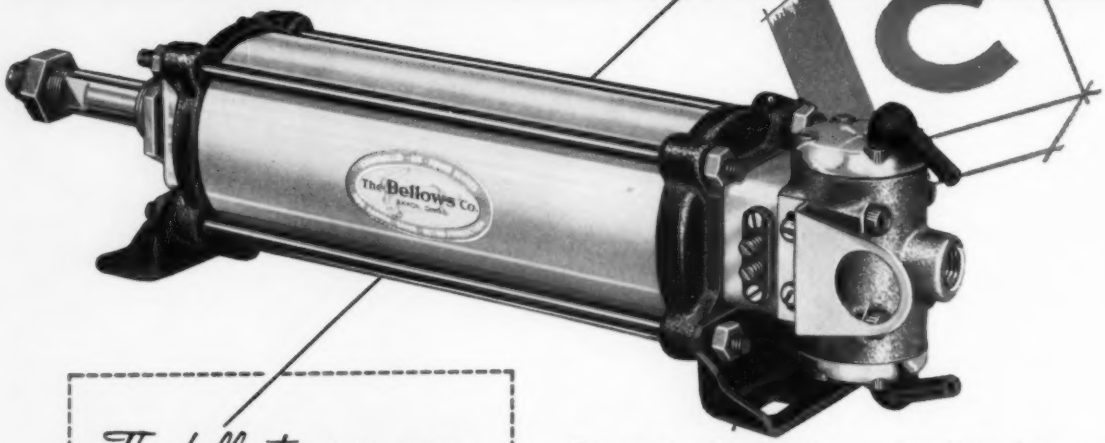
Circle 696 on Page 17

Tops in "CONTROLLED"
Air Cylinder Power

The BELLOWS AIR MOTOR



The full story is yours for the asking—

Write for this free new booklet. Bulletin BM-25 gives detailed data and specifications that will enable you to decide for yourself how Bellows Air Motors will save you time and money.

Address Dept. AU 1157 The Bellows Co., Akron 9, Ohio.

In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ont.

It's as simple as ABC — "control" is the essential difference that makes Bellows Air Motors do a better job at lower cost than conventional air cylinders.

In Bellows Air Motors control is an *integral part of* the air cylinder. There are no extra valves to buy — no complicated and cumbersome piping to install. The Bellows Air Motor is a complete power unit in itself.

What does it mean in terms of

- **BETTER PERFORMANCE?**
- **GREATER ECONOMY?**

It means instant action. The moment you shift the valve (either electrically or mechanically) the piston responds. No hesitancy — no chatter — no delay. It means simpler installation, easier interlock; "Controlled-Air-Power" fits in naturally with related machine movements. It means lower installed cost — lower maintenance costs.

618-B

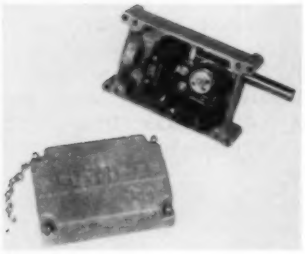
The Bellows Co.

AKRON 9, OHIO

AUTOMATION new components

Parts, elements and devices designed for creating more automatic systems

For detailed information and literature, use card page 17.

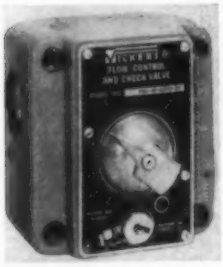


Rotary Limit Switch

Item 436

Unit is for machine tools, automation equipment, motor operated doors and windows, or any place where a motor drives a mechanism through a rotating motion. Device has three limit switches and three independently adjustable cams. Ratios of 5 to 1, 10 to 1, 20 to 1 are available. Switch comes in a molded Fibraloy watertight or explosion-proof enclosure. **Gemco Electric Co.,** 25685 W. Eight Mile Rd., Detroit 40, Mich.

Circle 436 on Page 17

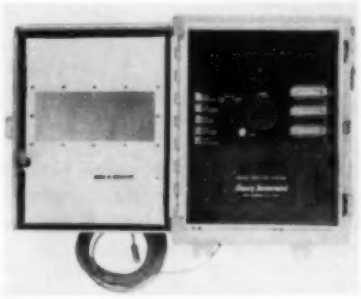


Flow Control Valve

Item 437

Device controls flow and compensates for fluid temperature changes as well as pressure changes. A single adjustable throttle is used for all flow rates from 5 to 1000 cu ipm, allowing a finer flow rate adjustment and reducing the possibility of mounting an incorrect valve. An integral check valve permits reverse free flow. Maximum reverse flow is rated at 1400 cu ipm. A setscrew prevents further adjustment of the selector knob, and a cover over the setscrew can be locked in place with a key. An optional "anti-jump" feature can be incorporated in the valve, which reduces the hydrostat inlet opening and decreases the volume of oil passed with sudden surges of inlet pressure. **Vickers Inc.,** Detroit 32, Mich.

Circle 437 on Page 17

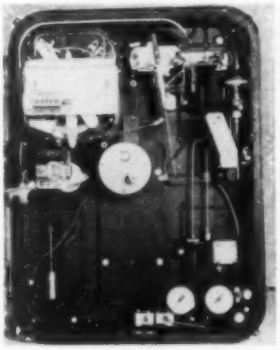


Packaged Control

Item 438

Designed for use on shears and other machines that cut and fabricate sheets of metal, plastic and fiber, electronic unit has many functions. It can be adapted to control steel sheet operations; count all cuts; measure productivity, and automatically operate many types of machine tools. An electronic touch sensor and a photosensor combine to control the shear for insuring correct dimensions, straight sides, and square corners. Totalizing counters record the number of sheets fabricated and the number of actual pieces obtained. **Sensory Inc.,** 506 Pleasantville Rd., New Vernon, N. J.

Circle 438 on Page 17



Ring Balance Meter

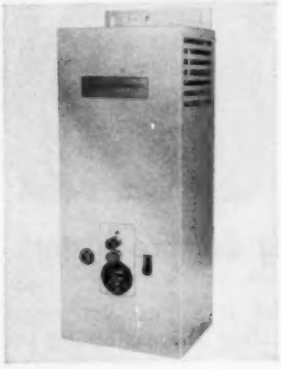
Item 439

Unit is suitable for recording, indicating and controlling process variables involving differential heads, flow, absolute pressures up to 20 psia, and liquid specific gravity. The actuating element is a hollow ring fitted with a baffle in the top and partly filled with a heavy fluid. Differential pressures, admitted to the ring through flexible *S* tubes on opposite sides of the baffle, give the ring a tendency to rotate around its axis and actuate the pen mechanism. The *S* tubes decrease static pressure effect, and the high ratio of ring torque to friction in the knife-edge bearings results in a sensitivity of one in 1000.

Features of the meter are an enclosed measuring system which allows no working parts to contact the measured fluid; stuffing boxes and pressure tight bearings are eliminated and dead weight

checking is obtained without disconnecting the meter piping, either at atmospheric or full static pressure. Dual type instruments containing two separate rings in a single case for simultaneous measurements can be used to register boiler steam flow-air flow ratio, compute flow in steam, gas, air, and liquid distribution systems, measure net solids in a liquid system, control air-gas mixtures, measure heat transfer in air conditioning and refrigeration systems. Pneumatic and electrical transmitters can be added to meters for remote service in recording, indicating, or integrating, or for actuating elements of automatic control systems. Receiver type meters are also available for accepting the pneumatic or electronic signals from remote sources. **Hagan Chemical & Controls Inc.**, 323 Fourth Ave., Pittsburgh, Pa.

Circle 439 on Page 17



Speed Control

Item 440

Unit converts 230v ac to half wave dc to drive a dc motor. Control is connected to a convenient 230v ac outlet, with the dc line taken off the Revotrol connection panel to the dc motor. If the motor will operate for considerable periods at 100 per cent torque and speeds below normal, proper allowance must be made in motor rating for the temperature rise normal to these lower operating speeds. Features claimed for the controller include preset speeds, no zero speed adjustment, line voltage adjusting taps, single tube circuit, encapsulated control components, dynamic braking, and protection from thermal overload, under-voltage and field voltage loss. Units are available for 1/6, 1/4, 1/3, 1/2 and 2/4 hp. **Acme Electric Corp.**, Cuba, N. Y.

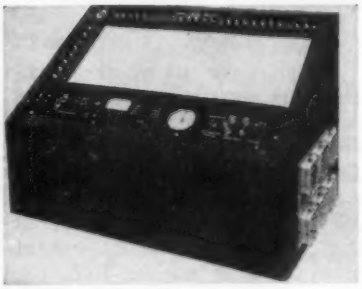
Circle 440 on Page 17

Excess Power Detector

Item 441

Electronic device senses current demand and prevents trouble caused by feed and material irregularities in automatic feed machines. Unit can be checked for sensitivity at any time without causing scrap by running the machine without material and then allowing the work material to flow into the die without holding in the reset button. Machine should trip the control and stop when the work material reaches the die. Machine can be restarted by holding in the reset button for approximately two seconds. Instrument can be installed on any machine having an ac electric motor drive 110, 208, 220, 440, 550, 660v; 50/60 cycle; single, two or three phase; up to 20 amp per leg. **Almy, Hayden & Maxwell Inc.**, 8 Anderson St., Marblehead, Mass.

Circle 441 on Page 17



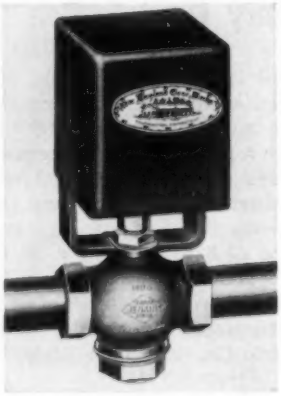
Functional Tester

Item 442

Designed for rapid, automatic tests of relay systems and associated wiring, Model 250 features a sensitive timer which can be switched into any circuit under test to measure the delay of time-delay circuits. It also has a vacuum tube ohmmeter which allows the operator to accurately measure circuit resistance in any circuit of the test group.

A plugboard programming system permits the terminations of the test circuitry to be connected to the tester by straightforward adapter cables, without reference to circuitry. Desired testing patterns are established by changing the jumperwire configuration on the compact plugboard. Design changes or modifications in the units being tested are easily incorporated into the testing procedure. **Electronics Div., Dit-Mco Inc.**, 911 Broadway, Kansas City, Mo.

Circle 442 on Page 17



Motorized Valve

Item 443

Unit is suitable for applications such as heating, air-conditioning, processing and original equipment. Gear-motor operator capable of closing the valve against rated line pressure operating through a full area seat opening is feature of motorized globe valve.

Other features include: automatic disc compensation; tight shut-off; 150 lb pressure capacities on most sizes; and permanent lubrication. Unit can be controlled by any positive action single-pole double-throw switch such as temperature, float, manual, time, program or pressure actuated switches. Valve is offered

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OF PRODUCTION PARTS!

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Special Air Gaging Fixtures designed and built to meet your particular application requirements. Complete engineering service available upon request.

Send part print showing all dimensions to be checked and tolerances required for prompt quotation and delivery.

To speed inspection of production parts, new Dearbornaire air gaging instruments are now offered in multiple column units designed to permit more accurate simultaneous checking of as many dimensions as may be required for a given part. What's more, each unit incorporates all of the advanced design features which have made Dearbornaire the most practical, most versatile column type instrument ever produced . . .

- New higher rated pressure system and built-in circuit restrictions make them virtually self-cleaning, reduce maintenance to a minimum.
- New glass tube has a characterized internal taper which provides positive linear accuracy over the full extent of the calibrated scales.
- Easy-to-read Zero-centered scales permit use of instrument for normal inspection, statistical quality control, and as a tool setting gage.
- Interchangeability of component parts simplifies conversion from one amplification to another, reduces spare parts inventory costs.

Plus a complete line of air gage spindles, rings, snaps and cartridges all precision finished to give you greater accuracy, longer wear life. Free demonstration arranged upon request. Write for details today!

AIR GAGE DIVISION
DEARBORN GAGE COMPANY
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Circle 698 on Page 17

40 pages
140 illustrations

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Chances are you will find a material handling situation similar to your own, illustrated and described in this new book!

The 140 actual installation photos in the Logan catalog show where and how to use the principal types of conveyors to best advantage in meeting individual plant conditions. Both standard and special applications are shown, making this book a valuable and informative reference, whether or not you contemplate using additional conveyors at this time.

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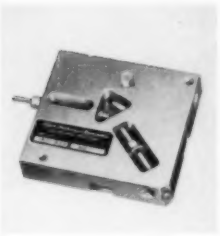
Logan Conveyors

in ten sizes ranging from ¼ to 3 inches; 24v, 115v, or 230v, and three timing cycles; 8, 32, and 139 seconds. **New England Gear Works,** South End Rd., Southington, Conn.

Circle 443 on Page 17

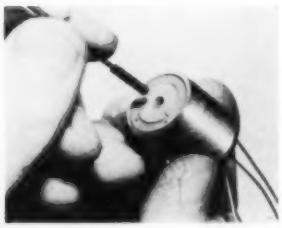


Mechanical Computer

Item 444

A bi-directional mechanical device for squaring or extracting square roots which can be used in all types of mechanical and electromechanical analog computers. Unit weigh 10 ounces with an aluminum casing; 20 ounces with a steel casing. The lightweight mechanism is stated to offer a high degree of accuracy and long life expectancy. **Belock Instrument Corp.,** 111-01 14th Ave., College Point, N. Y.

Circle 444 on Page 17



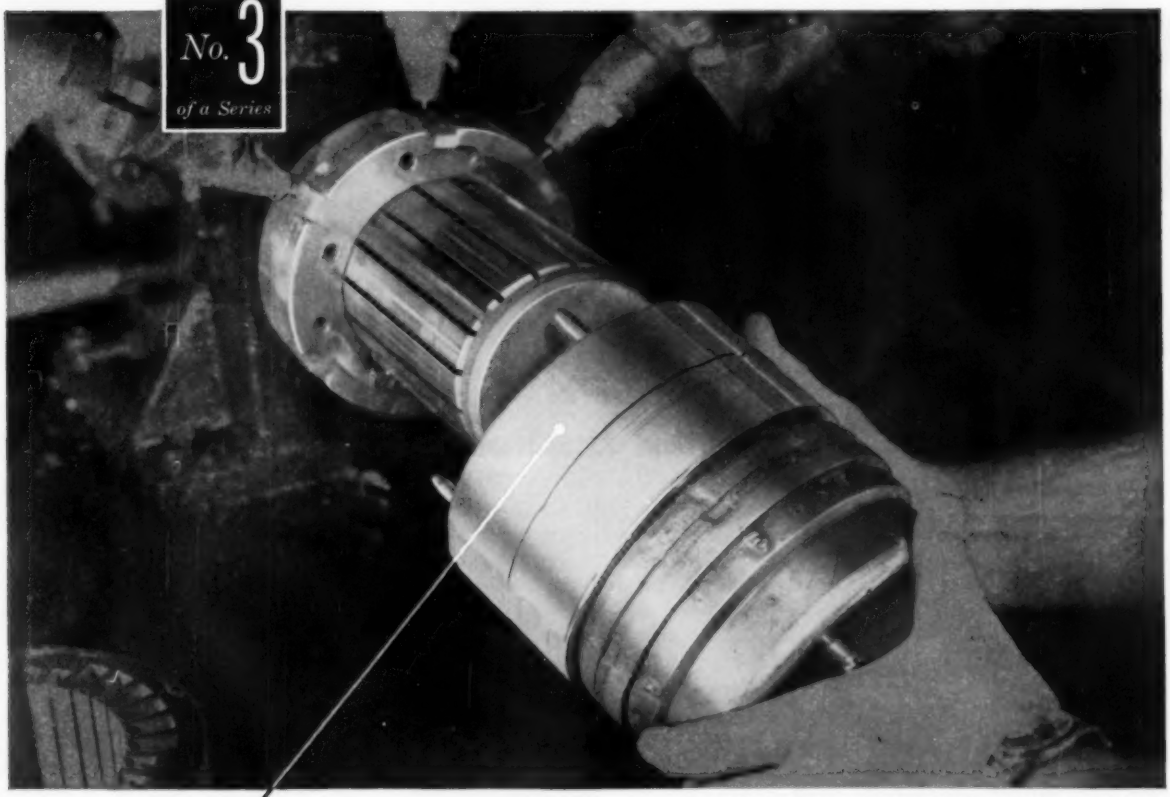
Differential Transformer

Item 445

Linear transducer is frictionless, with no sliding or bearing surfaces and meets specifications for a null voltage of less than 2 mv. Coil is designed for an armature range of ±0.020 inch. The output, from two series aiding secondaries to a transistorized amplifier, is linear within 1/10 of 1 per cent. Input is 6.3v at 400 cps. Glass impregnated melamine bobbin, silicone vacuum impregnated coil, and Teflon insulated wire assure continuous operation at any tempera-

Erickson Precision Expanding Mandrels Solve Assembly Problems

No. 3 *of a Series*



Photos: Courtesy The Emerson Electric Mfg. Co., St. Louis

e.g. electric motor stators

Emerson Electric, big-name electrical manufacturer, assembles stator laminations the modern way—with Erickson Mandrels. Gone are the old-fashioned arbor assembly methods that require a large tolerance between laminations and arbor . . . that lead to eccentricity of stator bore and to additional finishing operations on the OD.

Emerson Electric works "from the inside out" with Erickson Precision Expanding Mandrels. Laminations are placed on a fixture and the fixture slipped over the expanding mandrel. Laminations are then welded together with two passes through a three-torch head.

Result? Stators are concentric within Erickson's guaranteed accuracy of five "tenths." And Emerson Electric gets a better motor with uniform air gap . . . that produces uniform torque and rated horsepower . . . that creates minimum electrical interference . . . and that lasts longer.

If this cost-cutting case history triggers your imagination, contact the nearest Erickson representative. He'll be pleased to demonstrate how Erickson Precision Expanding Mandrels can cut your assembly costs.

AA-4133

Collet Chucks
Floating Holders
Tap Chucks
Indexers

ERICKSON TOOL COMPANY

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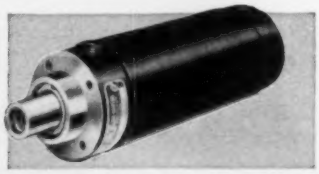
Tap Holders
Air-Operated Chucks
Expanding Collets
Special Holding Fixtures

ID of stator assembly (lower left) requires no finishing operation after welding.

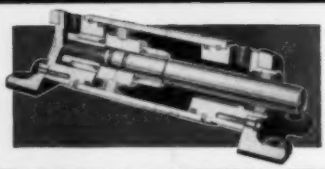
Bothered by a tough holding problem? Then let us show you how Erickson mandrels speed production, lower grinding or inspection costs. Write for Catalog K.

Circle 700 on Page 17

O-M
COMPACT IN DESIGN
KING SIZE
IN PERFORMANCE



O-M Tie-Rodless Cylinder
150 psi Air — up to 1500 psi Oil



Meets JIC Standards
Fits Where Others Won't

Here's the famous O-M Original Tie-Rodless Cylinder that takes one third less installation space than conventional tie-rod type yet packs plenty of power on both air or hydraulic circuits.

The result of modern research, design and engineering know-how, this powerful O-M component figures importantly in today's automation picture. Its high operating efficiency and ease of maintenance combine with its space-saving design and rugged construction to make it highly desirable in any application where its capacity meets specifications. Ports are easily oriented to any position.

O-M Air and Hydraulic Tie-Rodless Cylinders are available in a complete range of sizes (1½" to 8" bores) with standard or heavy duty rods. Completely interchangeable parts and mounts. Immediate delivery on many sizes.

Mail coupon now for Bulletins 101A (O-M Tie-Rodless Air and Hydraulic Cylinders) and 105 (O-M Series T-H Heavy duty Hydraulic Cylinders).

ORTMAN-MILLER MACHINE CO.
25 143rd Street, Hammond, Indiana

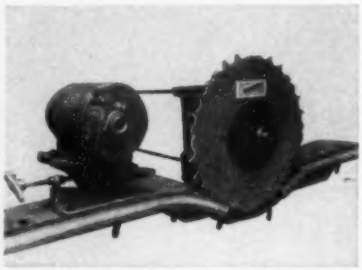
☐ Have representative call
☐ Send Bulletins 101A and 105

Name_____ Position_____
Company_____
Address_____
City_____ Zone____ State_____

Circle 701 on Page 17

tures up to 440F. The case is cut with micrometer threads permitting precise positioning after installation. **Automatic Timing & Controls Inc.**, King of Prussia, Pa.

Circle 445 on Page 17



Overload Attachment

Item 446

Device is a friction clutch mounted on the gear reducer shaft which engages directly with the drive sprocket face. The unit permits the drive sprocket to override in case of any overload occurring in the system and immediately relieves all driving force on the chain, while the power drive continues to run. Friction clutches are precision pre-set for full overload protection. **Chainveyor Corp.**, 5618 E. Washington Blvd., Los Angeles 22, Calif.

Circle 446 on Page 17

Pressure-Controller

Item 447

Air gaging unit gives precise downstream pressure control over wide supply pressure variations, remains stable through temperature changes or flow variations.

Instrument uses a high-gain servo system with main valve action controlled by a pilot nozzle which is activated by slight pressure variances. Instantaneous adjustment of controlled pressure is assured by the small relative movement required between the pilot valve and its seat in order to initiate changes in main valve action.

Gages are available in ranges of 2-25 and 3-60 psi and ⅛ and ¼-inch pipe sizes. **Bellofram Products Corp.**, Burlington, Mass.

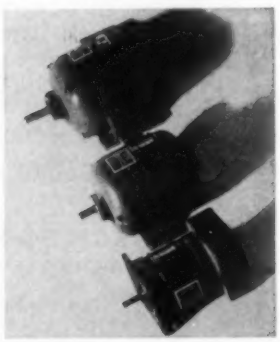
Circle 447 on Page 17

Photoelectric Relay

Item 448

Device is adaptable for use on counters, smoke detectors, register control and tension control. Model P-25 features high speed sensitive relay, power supply, photocell and lens assembly contained in one case. It plugs into a 120v line and works without tubes or transistors. Light source may be a standard household lamp. Relay is available in the plug-in or splice-box type. **Tri-Tronics Co.**, 2607 St. Charles Rd., Bellwood, Ill.

Circle 448 on Page 17



Torque-Brake Units

Item 449

Designed to provide continuous tension, compact torque-brake

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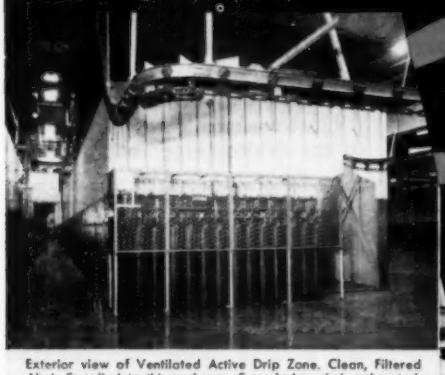
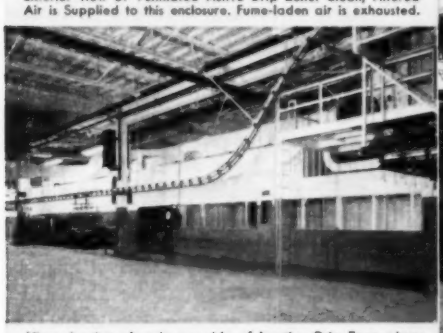
. . . for ENAMELS • LACQUER • PAINT • VARNISH



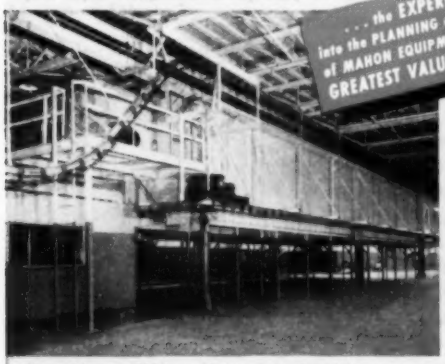
Exterior view of Ventilated Active Drip Zone. Clean, Filtered Air is Supplied to this enclosure. Fume-laden air is exhausted.



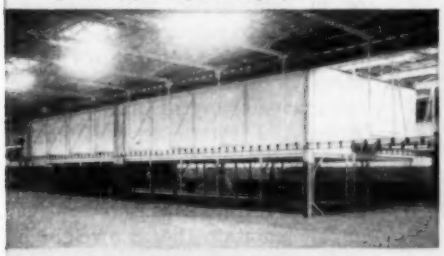
View showing glass in one side of Inactive Drip Zone where parts may be seen prior to entering Baking Oven.

View of Mahon Flow-Coating Equipment at Chrysler Corporation of Canada, Limited. This is part of a Complete Mahon Finishing System for Coating Black Enamel Parts.

. . . the EXPERIENCE that goes into the PLANNING and ENGINEERING of MAHON EQUIPMENT is the item of GREATEST VALUE to YOU!



View of Mahon 450° Enamel Baking Oven. Oven is built against ceiling trusses to provide parts storage space below.



Another view of the Enamel Baking Oven. Finish is baked for 20 minutes at 450° in this 80 Ft. x 24 Ft. Mahon Oven.

Black Enamel Parts at CHRYSLER CORPORATION of CANADA, LIMITED, are FLOW-COATED in MAHON FINISHING SYSTEM!

In addition to the body finishing system at the Windsor plant of Chrysler Corporation of Canada, Limited, Mahon also installed a complete finishing system for black enamel parts. This is a Flow-Coating System which includes a Mahon Flow-Coating Machine, a Ventilated Active Drip Zone, a Ventilated Inactive Drip Zone, and a 450° Finish Baking Oven with storage space below. Two Enamel Mixing Tanks and a Solvent Tank are provided outside the enclosure. The recirculating unit is equipped to automatically maintain the enamel at a specific temperature in the Flow-Coating Chamber. This is a typical Mahon Flow-Coating System, complete in every detail—automatic from start to stop. If you have a finishing problem, or are contemplating new finishing equipment, you will find that Mahon engineers are better qualified to advise you on both methods and equipment requirements . . . and better qualified to do the all-important planning and engineering of equipment—which is the key to fine finishes at minimum cost. Whether your job is to be Flow-Coated, Dip-Coated, or Spray Painted either Manually or by Electrostatic Process, you will find that Mahon equipment will serve you better, because it is engineered better and built better for more economical operation over a longer period of time. Mahon will do a complete job for you on one contract—undivided responsibility for the entire system insures proper coordination and safeguards you against complications which can upset your production schedules. See Mahon's Insert in Sweet's Plant Engineering File, or write for Catalog A-657.

THE R. C. MAHON COMPANY • Detroit 34, Michigan

SALES-ENGINEERING OFFICES in DETROIT, NEW YORK and CHICAGO

Engineers and Manufacturers of Complete Finishing Systems—including Metal Cleaning, Pickling, and Rust Proofing Equipment, Hydro-Filter Spray Booths, Dip and Flow Coaters, Filtered Air Supply Systems, Drying and Baking Ovens, Cooling Tunnels, Heat Treating and Quenching Equipment for Aluminum and Magnesium, and other Units of Special Production Equipment.

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Circle 702 on Page 17

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⅛-inch steel construction • Built-in vibrating feeder that will not jam • Maintains maximum feed rate which bowl will produce.

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Moore equipment is available either as individual components or in complete package units with positioning devices. Package units can be supplied already tooled up or for tooling up in your own plant.

Write for further information or for our recommendations for your particular automation requirements.

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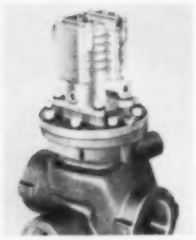
Circle 703 on Page 17

units are suitable to wire winding. Curves show the unusual characteristics of the three torque-brake units. Torque can be decreased by reducing the applied voltage or increased if intermittent ratings are permissible in the application. All units are 220v, 3 phase, 60 cycle. **B. A. Wesche Electric Co.**, 9027 Shell Rd., Cincinnati 42, Ohio.

Circle 449 on Page 17



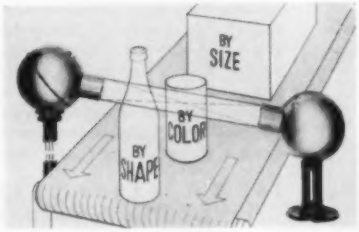
Poppet-Type Valves

Item 450

Device designed to actuate large brakes and clutches and for other pneumatic applications. Short poppet travel provides shorter machine cycle time, more accurate cuts when valve is used on high speed cut-offs, less brake and clutch slip. Minimum machine drift and overtravel are other gains possible from faster valve response.

Constructed with only 3 moving parts, the air-cushioned poppet is operated by a standard PC solenoid pilot. Working pressures range from 100 to 200 psi, in 1, 1¼ and 1½-inch NPT sizes. **Valvair Corp.**, 454 Morgan Ave., Akron 11, Ohio.

Circle 450 on Page 17



Photoelectric Control

Item 451

Instrument watches and controls qualities such as size, shape, color, quantity, texture and position, without physical contact. A 5-inch diameter sphere houses the eye, amplifer and relay. A second sphere contains the light source and transformer. All operating components in the receiver sphere are assembled in its top half, which is removable and plugs in to facilitate servicing of the system. The only wires from the system are leads to the power line and to the device being controlled.

A calibrated sensitivity control, adjustable from outside of the housing, provides for locating the spheres close together or far apart. An adjustable lens focus system permits focusing the light paths of both receiver and projector to allow a small object to break the light beam a few inches or a few feet away from the lens. Distance between receiver and projector may be up to 10 feet. Sphere housings are interchangeable and replacement of parts involves removing one bolt, separating halves, making replacement, reassembling and tightening bolt. The unit is waterproof, splashproof, and vaporproof and has a swivel adjustment. **Basic Controls Co.**, 1714 Westwood Blvd., Los Angeles 24, Calif.

Circle 451 on Page 17

Weighing Cell

Item 452

Weighing unit can be used alone or in combination with company equipment to reject under- or overweight packages, to control a fill valve or head, and to make a continuous recording of net weight. Model 209 determines weight by producing an electrical position signal indicating the deflection of a temperature compensated spring. It can maintain the net weight of packaged goods within close tolerances in high-speed filling operations. The system can determine and balance out the varying weights of containers and monitor the net weight of the product quickly. Design of the unit uses a frictionless suspension without piv-

Advertisement

TELEPHONE-TYPE COMPONENTS EXTENSIVELY USED IN CONTROL CIRCUITS

Quality, use-tested equipment offered in new Kellogg catalog.

A new catalog which features telephone components that are being used in automation has been published by the Kellogg Switchboard and Supply Company. Some of the items included are:

Cam Keys. Built on a perfect center line or T-frame, making it possible to assemble any number of spring combinations on either the locking, restoring, or both locking and restoring types which are always interchangeable. A variety of Kellogg Cam Key escutcheons is also available.

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Spring Jacks. A variety of designs to fit various plugs. Available singly or in strips of 10 and 20. Both two and three-conductor designs.

Combined Drops and Jacks. Available singly or in strips of 5 and 10.

Plugs. Two and three-conductor plugs in a variety of sizes. Also four-conductor plugs.

Lamps, Lamp Caps, and Lamp Jacks. The lamps are specially made to be uniform in size, current consumption and brilliance. Caps are available in a wide range of colors and sizes. Lamp jacks are available singly or in strips of 5, 10, and 20.

Relays. Kellogg relays are of simple design and sturdy construction, built to the most exacting specifications. They can be furnished in a wide variety of spring combinations and coil resistances. Types available include—alternating current relays, micrometer adjustment relays, trip and restoring relays, harmonic relays, polarized relays. Magnetic impulse counters.

Coils and Condensers. Coils offered include relay coils, repeating coils, induction coils. Several types of condensers are offered.

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The catalog may be obtained by writing your Kellogg Switchboard and Supply Company branch office or warehouse.

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Pictured above are a few of the many types of keys, relays, jacks, plugs, and other components which Kellogg supplies to industry. 60 Years of experience stands behind the reliability of these important parts. Write today for your Kellogg Industrial Catalog.

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KELLOGG SWITCHBOARD AND SUPPLY CO.
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QUALITY COMPONENTS FOR INDUSTRIAL CONTROL
QUALITY COMMUNICATIONS SYSTEMS

Circle 704 on Page 17

Difficult batching problems solved by Autoweightion*

- *All types and combinations of materials successfully handled*
- *High degree of accuracy obtainable*
- *Thayer Scale Flexure Plate Leverage System guaranteed accurate for life*

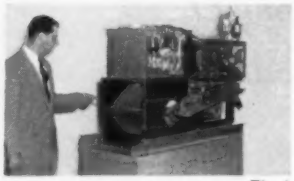

Fig. 1

The development of the Thayer Autoweightion System for controlling materials processing systems has opened the door for many hitherto impractical batching operations. For instance, several different flushing materials (flooding powders) can now be handled without leakage by a tipping bucket weigh hopper (Fig. 1) controlled by a series of different range Thayer weigh beams.

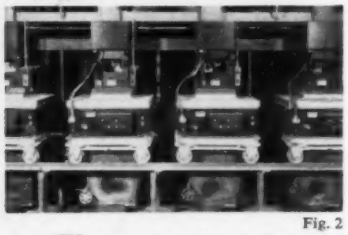

Fig. 2

Thayer individual batching scales can be used to furnish preweighed charges which may be varied in weight to suit the formula. The system shown (Fig. 2) can be furnished to allow positioning under various bins or feeders so each scale will preweigh a given weight charge and discharge it to a conveyor belt or to a mixer for further processing.

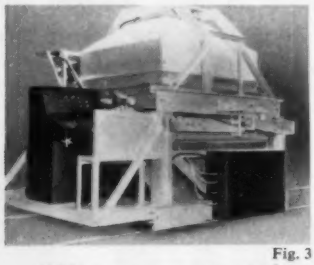

Fig. 3

Where many ingredients are to be handled and there is a factor of space saving and a minimum amount of equipment, it is possible to utilize an accumulative batching scale which can either be fixed or moveable as shown (Fig. 3). This unit will have a large weigh hopper sufficient to accommodate the total weight of any number of ingredients desired to be accumulated. To secure accuracy in various weight ranges, the weighing of each individual ingredient will be controlled by its own weigh beam on the scale and the various ingredients will be weighed into the common weigh hopper in turn at the prescribed formulated weight.

Difficult to handle materials, such as hot tar, high viscosity liquids and other such ingredients which leave a residue in the weighing vessel can be handled in a loss-in-weight manner by first precharging a vessel to any weight and then withdrawing a known amount for the desired charge (Fig. 4). By this means the remaining tare weight within the hopper will not affect the weight of the next discharged load. Such a unit can be used either as a single batching scale or as an accumulative batching scale discharging in a loss-in-weight manner.

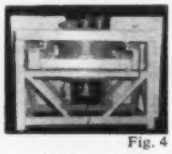

Fig. 4

Engineered solutions such as these have put Thayer batching systems into many of the best known processing plants in North America. Thayer builds a complete line of feeders interlocked with Thayer Scales. Remote controls, adding machines and chart indicators are also supplied. Please write us about your batching problems.

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* THE THAYER SYSTEM OF PROCESS CONTROL BY WEIGHT

THAYER SCALE CORP.
5 Thayer Park, Pembroke, Massachusetts

ots, and an enclosure which permits operation under humid and dusty conditions. **Avion Div., ACF Industries Inc.,** 11 Park Place, Paramus, N. J.

Circle 452 on Page 17

Motorized Spindle

Item 453

Unit is suitable for industrial applications requiring submersion in atmospheres at elevated temperatures. Operation of 10 hp, 21,600 rpm motorized spindle in 450F atmosphere is accomplished by the continuous liquid cooled design incorporated in the spindle and motor housing. The spiral-flow liquid cooled design limits the temperature rise as recommended for efficient motor performance. Design is applicable to 60 cycle or high frequency motorized spindles. **Standard Electrical Tool Co.,** 2550 River Rd., Cincinnati 4, Ohio.

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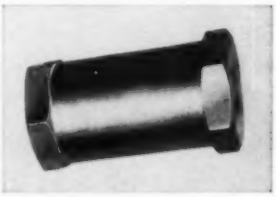


Check Valve

Item 454

Unit weighs four ounces, has a differential cracking pressure of 1 psi maximum and differential sealing pressure is less than 1 psi. Valve is simply constructed, the only moving part is a poppet. It can withstand operating pressures of up to 125 psig and temperatures up to 175F. Valve is available in two models, ½ inch and ⅜ inch pipe size. **Ross Operating Valve Co.,** 120 E. Golden Gate Ave., Detroit 3, Mich.

Circle 454 on Page 17

(Advertisement)

MORE EFFICIENT DESIGN, IMPORTANT SAVINGS, SIMPLIFIED ASSEMBLY, BETTER APPEARANCE

These are some of the many benefits reported by Design Engineers who have adopted TRU-LAY PUSH-PULLS for remote control operations on literally hundreds of products

Here are typical comments recently received from equipment manufacturers whose machines or implements are equipped with these accurate and dependable remote controls:

Saves Time, Labor and Material
"The use of your flexible Push-Pulls saves us a great deal of time, labor and material. The old linkages frequently required much planning in both engineering and shop which is not required now. On some of our equipment we use Push-Pulls from 10 to 30 feet in length. They operate clutch controls on the Main Power Unit, Feed Conveyors and Delivery Conveyors."

Greater Flexibility of Design
"The principal advantage of Tru-Lay Push-Pulls in our application is that they permit flexibility in locating the control valve in relation to the operator's position."

Cost Less to Install
"Tru-Lay Push-Pulls are easier and less expensive to install than linkages for remote control of power take-off, brake and clutch. Better appearance, too."

Simple and Neat
"For several models of farm tractors, we selected your controls for their simplicity and neatness of application as governor controls."

Solution to Tough Problem
"Can be installed where straight rods are impossible . . . for Remote Control of transmissions, brakes and clutches."

Eliminates Maintenance
"Simple operation and elimination of maintenance problem are the major advantages in using your Push-Pulls."

Reduces Number of Parts
"Your Push-Pulls have eliminated links, radius rods and other lost-motion devices for remote control of hydraulic valves."

Provide ACCURATE Control
"Tru-Lay Push-Pull control cables provide minimum back-lash, even in installations up to 30 feet in length, because the cable is designed to close tolerances with minimum drag and lost motion."

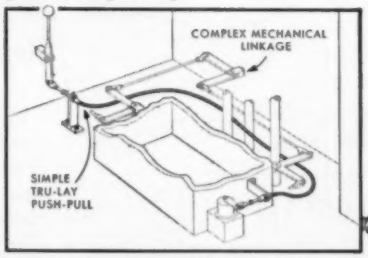
• • •

TRU-LAY PUSH-PULLS are "Solid as a rod but *Flexible* as a wire rope." This flexibility makes it possible to snake around obstructions . . . permits the ideal arrangement of all elements of remote controls.

***Advantages** of Tru-Lay Push-Pull flexibility and simplicity are pictured below—*

Simplicity vs Complexity

Compare the TRU-LAY PUSH-PULL cable in illustration with the mechanical linkage. PUSH-PULLS are simple, have but one moving part, are noiseless and give lifetime service accuracy. Linkages are complex, made of many parts; they wear at many points. Their use brings increased backlash, lost accuracy and vibration rattles.



Construction Equipment and **Farm Implements** provide good examples of the wide-spread use of these accurate, simple and dependable Push-Pulls. On Power Shovels, Winches, Graders, Road Oilers, Dump Trucks, Snow Plows, Engine-driven Pumps, Crushers, Tractors, Combines, Corn Pickers, Corn Row Sprayers, Corn Detasslers, Orchard Sprayers, Power-driven Tree Trimmers, Tobacco Picking Machines and others . . .

TRU-LAY PUSH-PULLS are operating unfailingly for the remote control of Hydraulic and Air Valves, Brakes, Clutches, Transmissions, Throttles, Chokes, Governors, Power Take-Offs, Spray Nozzles, Vent Directional Fins and on many other applications.

ACCO *Our DATA FILE will answer all further questions*

AUTOMOTIVE and AIRCRAFT DIVISION
AMERICAN CHAIN & CABLE

601 Stephenson Bldg., Detroit 2
2216 South Garfield Ave., Los Angeles 22 • 929 Connecticut Ave., Bridgeport 2, Conn.

TRADE MARK

There is No Worry about Failures or Maintenance Costs with TRU-LAY Push-Pull Remote Controls

Long Life is a matter of record. We have never heard of a Tru-Lay Flexible Push-Pull Control wearing out in normal service. Failures, that sometimes harass users of more complex controls, are eliminated by the use of these simple, positive-action controls.

Dependable Operation of these controls is a certainty, even under the most adverse conditions . . . HOT as jet engines (note: Tru-Lay Push-Pulls are actually performing on hot jet applications) . . . COLD to 70° F below zero . . . SOAKIN' WET . . . ABRASIVE . . . or just plain TOUGH.

Freedom from Trouble is assured because of such features as . . . full protection of the inner, working member by the tough flexible conduit . . . lubrication of the inner, working member *for life* during assembly . . . seals that keep moisture, dust and other foreign matter out of the unit . . . cold swaging of fittings that makes them integral parts of the control unit.

Accuracy is inherent in the basic design of Tru-Lay Push-Pulls. They are precision products, not gadgets.

Capacity ranges from light jobs up to jobs of 1,000 lbs. input. These Push-Pulls will handle jobs 150 feet or more from the control point.

"Solid as a rod, Flexible as a wire rope" aptly describes Tru-Lay Push-Pull Controls. This flexibility provides positive, remote action whether anchorages are fixed or movable . . . it damps out noise and vibration . . . it greatly simplifies installation of controls by reducing the number of working parts and by making it possible to snake around obstructions.

Adaptability to all sorts of mechanical situations explains, in large measure, the wide-spread application of Tru-Lay Push-Pulls. Standard anchorages, fittings and heads have been designed that meet requirements on approximately 80% of the installations. Simple modifications of these standards, or minor changes in your own design, cover almost every special situation. Our engineers have the know-how on such matters, and will work with you.

For Further Information—The DATA FILE pictured at the left contains six booklets and bulletins that will answer any further questions you may have about this versatile and dependable tool. It is quite likely that this material will point the way to a simplified solution of your remote control design problems. Write for a copy.

"We lift the box— not the furnace!"

Lennox Industries, Inc., eliminates heavy lifting in packaging by placing lightweight H&D corrugated boxes around warm air furnaces. Cuts shipping costs, too. Heavy product? Better see H&D.

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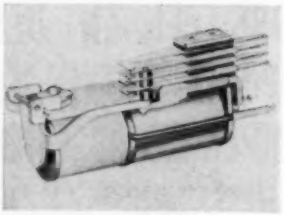
14 FACTORIES • 42 SALES OFFICES



Telephone Relay

Item 455

Capable of operating at high speeds for long continuous periods, telephone relay has contact combinations up to 10 pole, double throw. Contacts are rated for 3 amp, 150 w, ac non-inductive load. The relay can be supplied with copper head for delayed attract up to 0.1 second depending upon spring assembly and coil power; copper heel for delayed release up to 0.4 second with small spring assembly and power coil. **Guardian Electric Mfg. Co.,** 1621 W. Walnut St., Chicago 12, Ill.

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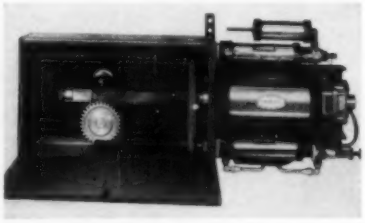
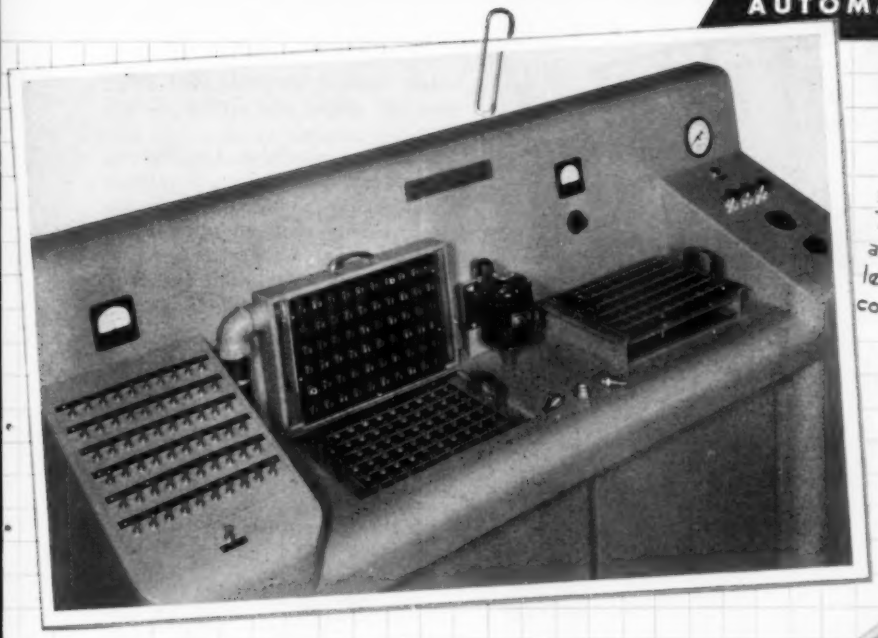


Heavy Duty Power Feed

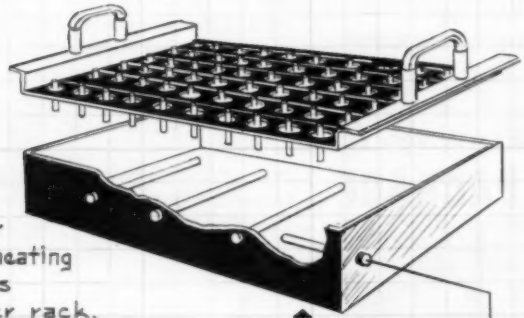
Item 456

Heavy duty unit is designed to power the feed on multiple drilling applications. Unit consists of a steel gear rack which drives a pinion gear mounted on a shaft with a hub as the drive unit. The 3000 in.-lb maximum torque delivered at the hub can be applied to any crossfeed shaft or driven shaft for rotational or linear movement. An air motor advances the gear rack with a thrust or 15 lb for each pound per square inch of applied air line pressure. Two Hydro - Checks govern the feed rate and balance the hydraulic reaction during the feed portion of the stroke. One valve controls the Hydro-Checks and adjusts the hydraulic feed rate. Speed of the advance or return stroke is adjustable by means of two throttle screws on the valve. Retract speed

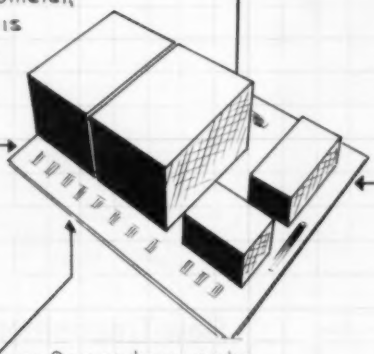


Engine thermometers are now tested to closer tolerances in shorter time. This Gemco console tests 60 units in water held to ±.5°F. Thermometers on plug-in rack are tied to galvanometer on left which indicates "Go-No-Go" conditions of each.

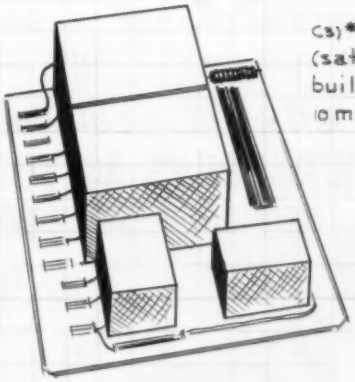
GEMCO SR* ASSURES ACCURATE TESTING



(1) Test water basin, with heating coil, receives thermometer rack. Standard thermometer, on side of basin, is tied to Gemco S.R. control.

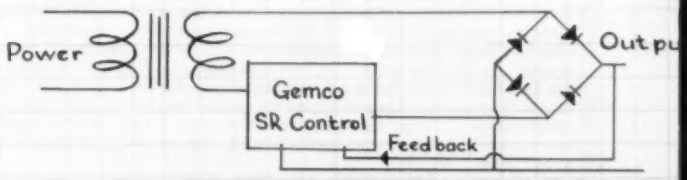


(2) Operator sets temperature on dial. If thermometer indicates variance from setting, S.R. control automatically changes power to heating coil. No vacuum tubes required.



(3) *Gemco S.R. Controls (saturable reactor) built for ratings from 10 milliwatts to 15kw.

(4) S.R. Control, driving selenium rectifier, also used to control 12 volt test supply to ±1%. Gemco has developed automatic controls for all kinds of processing and handling problems.



Circle 708 on Page 17

This specialized experience can help you. Write, wire or call us - today.

GEMCO

CUSTOM CONTROLS

GEMCO ELECTRIC COMPANY

25681 W. 8 Mile Rd. • Detroit 40, Mich.

NEW! FREE!

HELPFUL DATA ON A-F ENGINEERED CONVEYING SYSTEMS

HOT OFF THE PRESS! Eight illustrated, file-size brochures covering all types of A-F Engineered Conveying Systems and Equipment.

Profusely illustrated with photographs of actual installations and containing a wealth of information—blueprints, specifications, facts on the proper application for each type of conveyor, etc.—each brochure is sure to give you many new ideas as to how your products handling problems may be solved.

Separate brochures are devoted to the following types of A-F *Engineered* Equipment:

- Live Roller Conveying Systems
- Gravity Roller Conveying Systems
- Rollers for Gravity and Live Roller Conveying Systems
- Belt Conveying Systems
- Apron Conveying Systems
- Chain Conveying Systems
- Drives and Take-Ups
- Inclined and Vertical Conveying Systems

Any one of these brochures could lead to valuable savings for your company—and they're FREE! Simply write us on your company letterhead, mentioning the brochures you'd like to receive.

YOU CAN SEE
THE SUPERIORITY
OF A-F CONVEYOR ENGINEERING

A-F

A-F *ENGINEERED* CONVEYING SYSTEMS

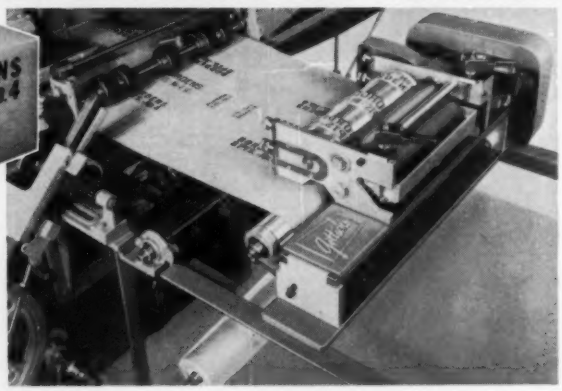
Also Pre-Engineered Conveyors—
Wheel, Trolley, Roller, Belt
Metal Cleaning and Processing Machines

THE ALVEY-FERGUSON CO., 175 Disney St., **CINCINNATI 9, OHIO** and Azusa, California

Circle 709 on Page 17

Now... an efficient, economical way to

IMPRINT WRAPPERS AS YOU PACKAGE



Compact Gottscho "Rolaprinter"® Attachment Fits All Wrapping and Bundling Machines

Ideal for imprinting anything from a code-date on a preprinted wrapper to complete display copy on 5 sides of a bundle overwrap. Fully automatic . . . requires no attention during operation, synchronizes with parent machine at regular production speeds . . . provides accurately positioned imprint. A miniature flexographic printer, the ROLAPRINTER attachment uses fast-drying liquid inks of any color and stick-on rubber type or dies. Assures consistent quality on all *films, foils* and *papers*. Mechanically simple . . . copy changes and adjustments for different wrapper sizes can be made quickly by untrained personnel. Models available to imprint areas from 1" to 24" wide.

For complete information please submit details of your requirements, including make and model of wrapping machine.

Gottscho

ADOLPH GOTTSCHO, INC.
Dept. V, Hillside 5, N.J.

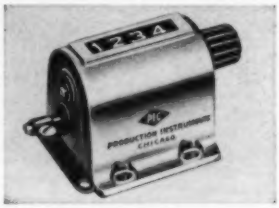
In Canada: **RICHARDSON AGENCIES, LTD., Toronto & Montreal**

Automatic Production-Line
CODING, MARKING, IMPRINTING MACHINES

can be used in the wide open position for rapid and frequent cycling.

Units are available for line or low voltage operations. A retract switch and an auxiliary switch, for synchronizing the unit with other equipment, are built into the unit. The auxiliary switch can act as a continuous cycling switch if so wired. **Bellows Co.**, Akron, Ohio.

Circle 456 on Page 17

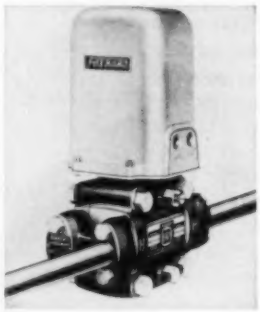


Small Stroke Counter

Item 457

Four-digit stroke unit counts to 9999. One turn of the knob resets to zero. Counter is available with rigid or spring steel operating arm, top-coming or top-going arm action, right or left shaft extension. Mounting holes in the cover prevent disassembly or tampering without complete dismounting. **Production Instruments Div., General Controls Co.**, 8078B McCormick Blvd., Skokie, Ill.

Circle 457 on Page 17



Flow Transmitter

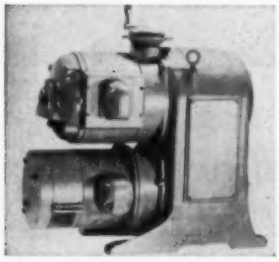
Item 458

Unit measures and transmits small flows, with a minimum range of 0.003 to 0.010 gpm of clean water and similar liquids and from 0.010 to 0.040 scfm of air and other gases. Instrument has a manifold with a removable orifice through which the measured fluid

flows. Resulting pressures across the orifice are applied to the high and low pressure sides of a standard silicone-filled twin diaphragm capsule. The differential, balanced by a pneumatic feedback mechanism, produces a 3-15 psi output signal proportional to differential pressure for remote indication or recording.

Six orifices in bore sizes from 0.020 to 0.250 inch are available with the transmitter. Simple removal of manifold permits change of orifice for new flow range. A conversion kit with a set of orifices and manifold is available for converting type 13A transmitter in the field to measurement of small flows. Transmitter range is adjustable between the limits of 0-20 and 0-250 inches of water. Maximum working pressure is 1500 psi; maximum working temperature 250 F. **Foxboro Co.,** Foxboro, Mass.

Circle 458 on Page 17

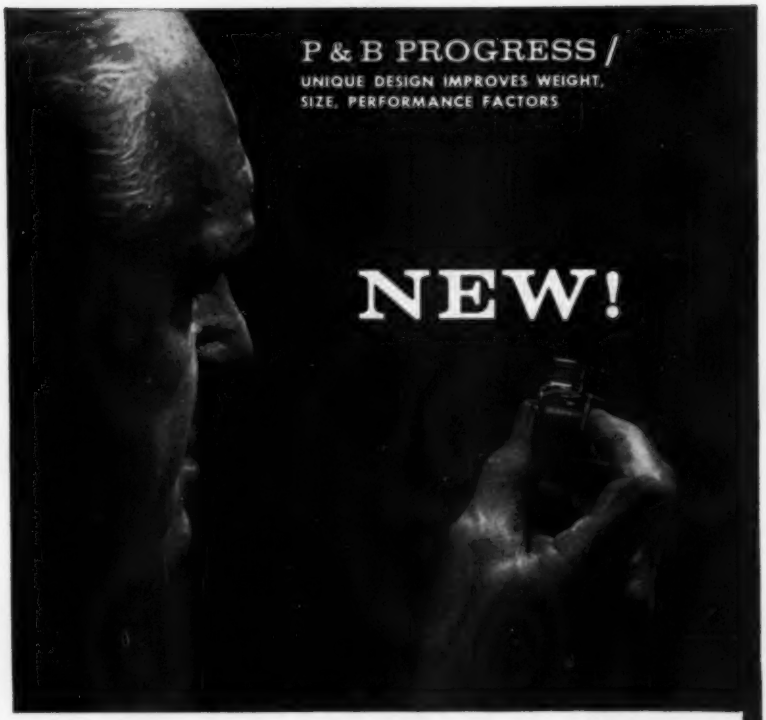


Variable Speed Unit

Item 459

Device converts standard motors into variable speed drives in applications where limited space, weight limitations, and environmental hazards are a problem. Any open, totally-enclosed, explosion-proof or internally geared 3-phase induction motor can be converted. Units can handle a total connected load of from 1 to 50 hp with speed variations of up to 5:1. The addition of Varitrol pneumatic control to the power unit automatically changes output speeds. This control will operate automatically in response to such variables as pressure, temperature, position, liquid level, and humidity. **U. S. Electrical Motors Inc.,** Box 2058 Terminal Annex, Los Angeles 54, Calif.

Circle 459 on Page 17

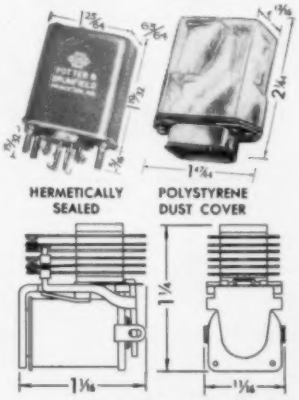


MINIATURE TELEPHONE TYPE RELAY HAS SUPERIOR SHOCK/VIBRATION RESISTANCE

Unusual for a telephone type relay, the MG Series has excellent stability under high shock and vibration conditions. Tests show this miniature, light weight (only 1.2 oz., open) relay withstands vibration of 10g 55 to 500 cycles per second and will operate under shock to 30g according to Mil-R-5757C.

The superior performance of the MG is due in part to its unique single stack construction and to an exclusive hinge design which provides zero heel gap.

Open, dust covered or hermetically sealed, the MG is available with contact arrangements up to 4 Form C (4PDT). It is rated for ambient temperatures of −55°C to+85°C. A high-temperature version with a range of −65°C to +125°C will soon be available. Write or wire today for complete specifications and delivery information.



MG RELAY

TERMINALS:
Open Relay: Pierced Solder Lugs. Contacts: Two #18 AWG wires. Coil: Two #20 AWG wires.
Hermetically Sealed: Miniature plug-in header with 7, 9 or 14 pins. Multiple Solder header with hook and terminals for three #20 AWG wires.
Polystyrene Dust Cover: Micro Ribbon plug-in type. Mating receptacle: Amphenol #57-20140 or similar.
INSULATION RESISTANCE: 100 megohms min.
VIBRATION: .065" excursion 10-55 cps. 10g 55-550 cps. upon request.
SHOCK: 30g according to Mil-R-5757C upon request.
TEMPERATURE RANGE: −55°C to +85°C.
WEIGHT: 1.2 ozs. (open) 2.0 ozs. (sealed).
PULL-IN SPEED: Approximately 15 ms at nominal voltage.
DROP-OUT SPEED: Approximately 10 ms at nominal voltage.
CONTACTS: 3/32 silver.
CONTACT ARRANGEMENT: 4 pole, double throw (4 Form C).
COIL POWER: 3 watts max. DC @ 25°C. Continuous duty.

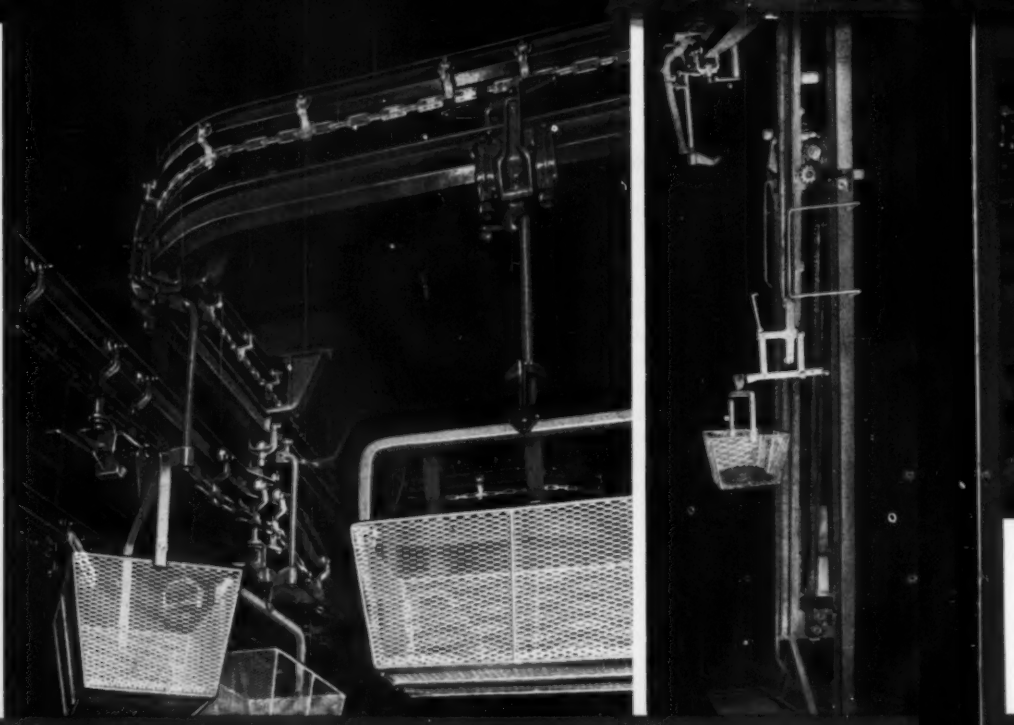
P&B STANDARD RELAYS ARE AVAILABLE AT YOUR LOCAL ELECTRONIC, ELECTRICAL AND REFRIGERATION DISTRIBUTORS

Potter & Brumfield, inc.

PRINCETON, INDIANA

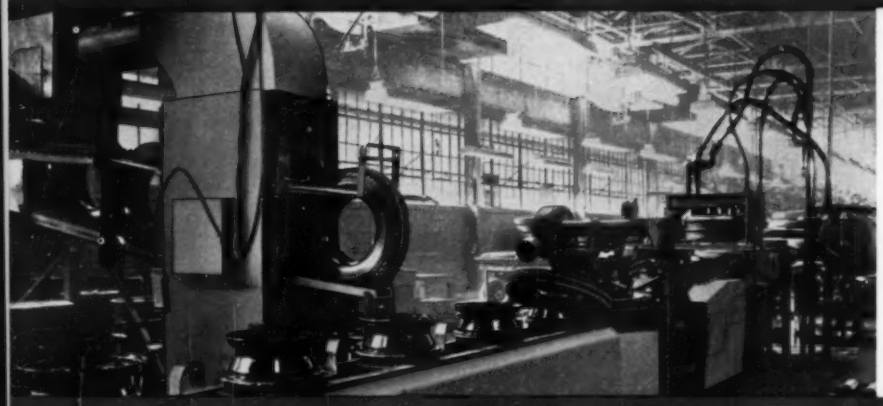
SUBSIDIARY OF AMERICAN MACHINE & FOUNDRY COMPANY
Manufacturing Divisions also in Franklin, Ky and Laconia, N. H.

Circle 711 on Page 17



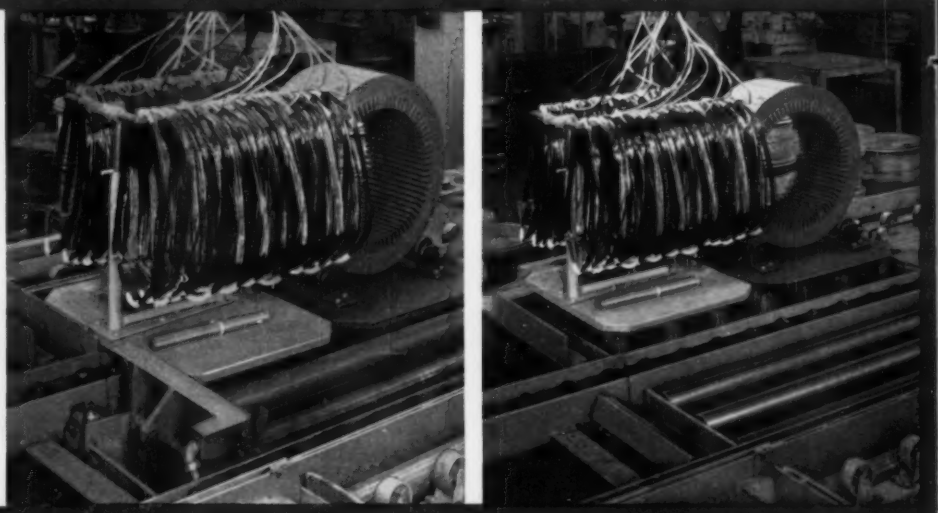
TRANS-FREE CONVEYOR
Automatic transfer from live line to free accomplished without physical handling. Some installations incorporate vertical elevators which allow all work transfer in unused overhead space.

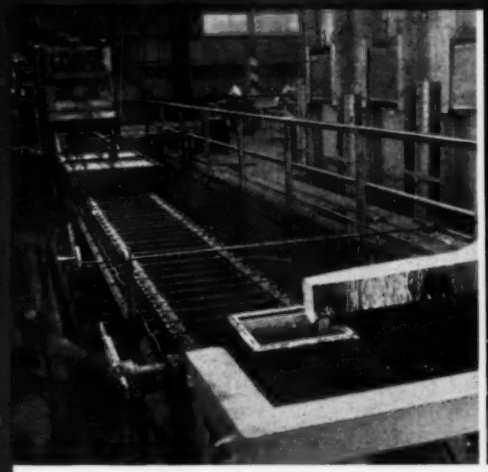
New Ideas by Allied for

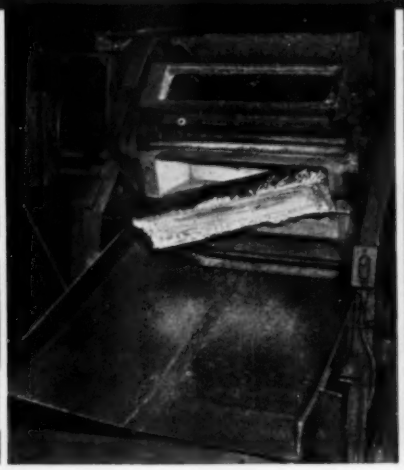


AUTOMATIC TIRE MOUNTER
Another Allied first, this mounter receives tires and wheels, soaps the bead and mounts the tire, and then *inflates and balances the wheel.* Wheels are untouched from beginning to end.

LIVE ROLLER TRANSFER
In this recent installation, pallet loads are maintained on a storage bank until a work station is freed. Load then travels to work station and is automatically transferred into work area without stopping the main conveyor. After processing, work is returned to the main conveyor with no time lost, no work stoppage for physical handling.







AUTOMATIC PIG STACKER — Prior to this Allied installation, ingots or pigs had to be stacked manually under hot and dangerous conditions by two 4-man teams who worked 15 minutes, then rested 15 minutes. With this automatic pig stacker, molds are poured, cooled while traveling down the conveyor line, shaken from the mold, and then stacked on pallets ready for forklift trucks, all automatically, completely without physical handling.

Automatic Product Handling

Allied has installed miles upon miles of overhead conveyors like many other conveyor companies. But length of installations alone is not the measure of the ability of a conveyor engineering team. The true measure is how they meet your individual product handling problems and solve them in a manner that will assure a maximum return on your investment. On these pages, Allied presents some of the cost-saving new ideas introduced by them in recent conveyor installations.

For more information about these and other Allied conveyor installations, please write on your letterhead.

TV SETTLER — Vibrations of the phosphorescent solution on a TV tube during settling causes ripples on the surface of the screen. Even the slightest quiver throughout this 40-foot conveyor would cause costly rejections. This Allied equipment was in operation within two months of the manufacturer's original request and has cut the rejection rate by 50% over the previous system of hand dipping.

ALLIED CONVEYORS

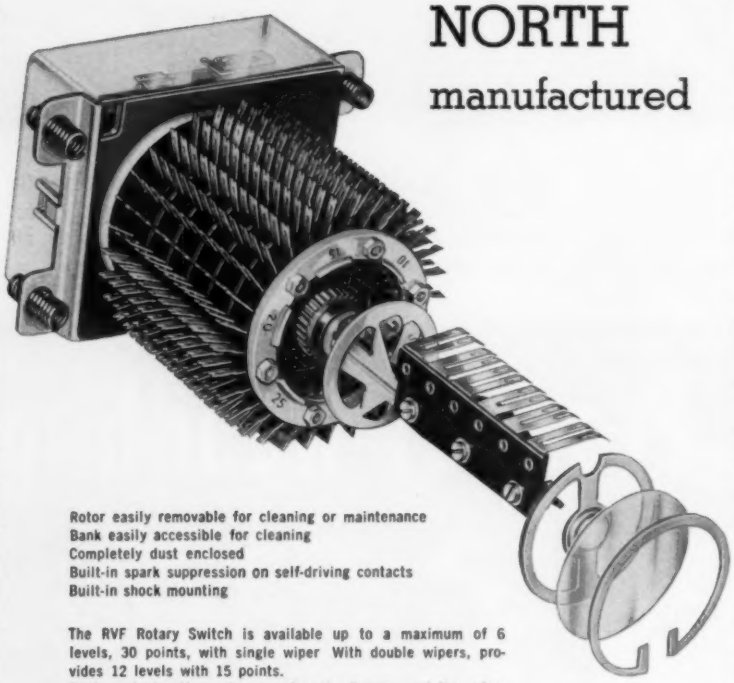
ALLIED STEEL AND CONVEYORS • DIVISION OF THE SPARTON CORP.

17361 HEALY AVENUE • DETROIT 12, MICHIGAN • CABLE ADDRESS: ALCON

Circle 712 on Page 17

RVF ROTARY SWITCH

wholly
NORTH
manufactured



Rotor easily removable for cleaning or maintenance
Bank easily accessible for cleaning
Completely dust enclosed
Built-in spark suppression on self-driving contacts
Built-in shock mounting

The RVF Rotary Switch is available up to a maximum of 6 levels, 30 points, with single wiper With double wipers, provides 12 levels with 15 points.
Bank contact ratings: 1 amp. at rest; .2 amp resistive when stepping Off normal contact ratings .4 amp resistive
Switch may be driven self-stepping or externally

Mounting dimensions: 1.968" x 3.661" O.C.
Overall height: 4¾"; height above mounting 3½" (max dimensions for 6 level switch).
Weight: 1 32 lbs

Since the introduction of the L. M. Ericsson RVF Rotary Switch by North Electric Company, it has gained nationwide acceptance as the outstanding Rotary Switch available.

The constantly increasing domestic demand for the RVF Rotary Switch will now be met by North Electric's virtually unlimited production facilities, where the switch is being wholly manufactured, not only in all the standard types to which the industry is accustomed, but also in variations specifically designed to meet your application needs.

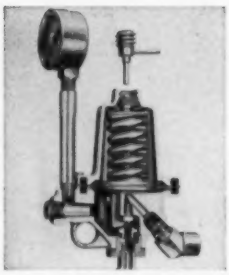
This represents another most significant step in North's program to provide a single source facility for all types of industrial switching components.

INDUSTRIAL DIVISION

NORTH ELECTRIC COMPANY

7211 SOUTH MARKET STREET • GALION, OHIO

Available in Canada through Ericsson Telephone Sales of Canada, Ltd., Montreal 8, P. Q.

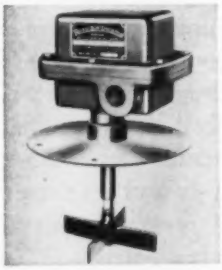


Pressure Regulators

Item 460

Diaphragm-type regulators provide sensitive, positive control of all fluid pressures without surge or variation in fluid supply lines for smooth, even, regulated fluid flow to all spray nozzles, eliminating plugging, clogging and material buildup. The Mylar diaphragm is impermeable to all known solvents, permanently separates fluid chamber from control mechanism. Blow-back valve allows flushing at any time without changing regulated pressure setting. Regulators can control all fluid pressures from fractions of a psi to 160 psi. Ball bearing adjustment key gives easy, accurate pressure adjustments. **Gray Co. Inc.,** 1001 Sibley St., N.E., Minneapolis 13, Minn.

Circle 460 on Page 17

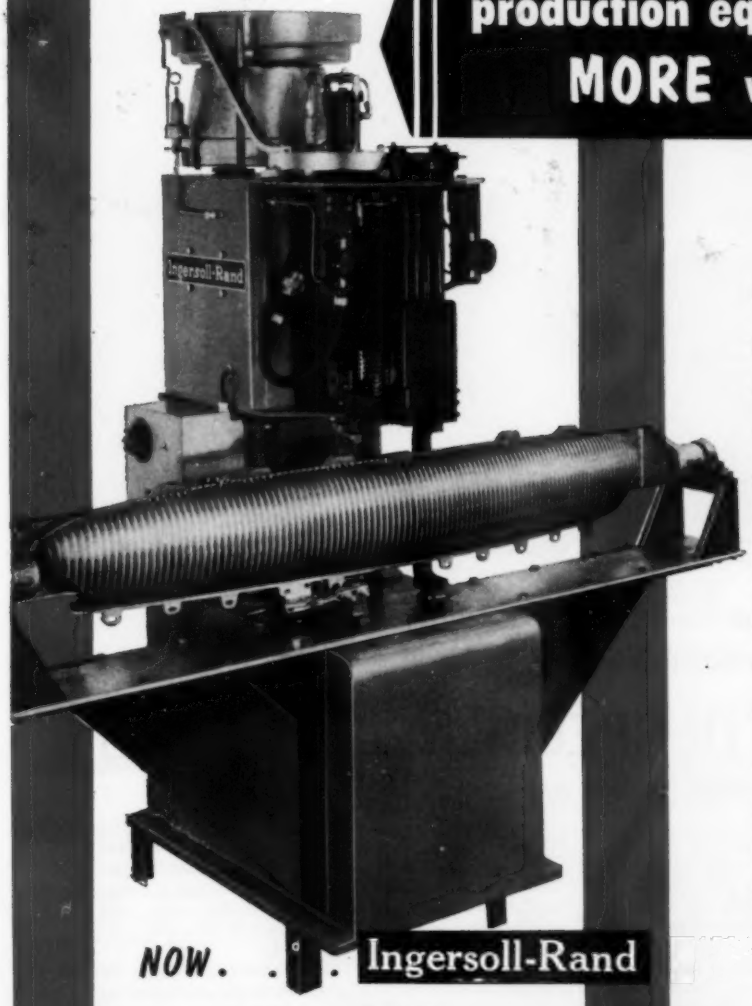


Level Control Device

Item 461

Unit is adaptable to rugged operating conditions, such as vibration and high stresses on the paddle and shaft assembly. It is suitable for installations in bins under pressure or vacuum, and bins, chutes or conveyors handling materials which tend to bridge over diaphragms. Indicator can be used in hazardous atmospheres such as vapors of ethyl ether, gasoline, petroleum, alcohol, acetone, lacquer solvent, or natural gas; at-

production equipment produces MORE with PEECO



NOW . . . Ingersoll-Rand includes DEVELOPED PEECO FEEDERS

The Ingersoll-Rand Model FSD4A1 (illustrated) feeds and drives eight self-tapping hex head screws for automobile radiator grille assembly. Completed cycle for this quality controlled, time saving operation is accomplished in less than one-half of the time formerly required.

IN THE field of vibratory parts feeders, PEECO'S leadership stands unchallenged. Manufacturers of production equipment for various markets are finding that PEECO'S engineering knowledge in small parts feeding is helping them increase the capacities of new production equipment. One of the many companies in the production field now being served by PEECO is the established name of Ingersoll-Rand.

If you want to produce more, send for bulletin #653 and ask for the name of the PEECO representative in your area.

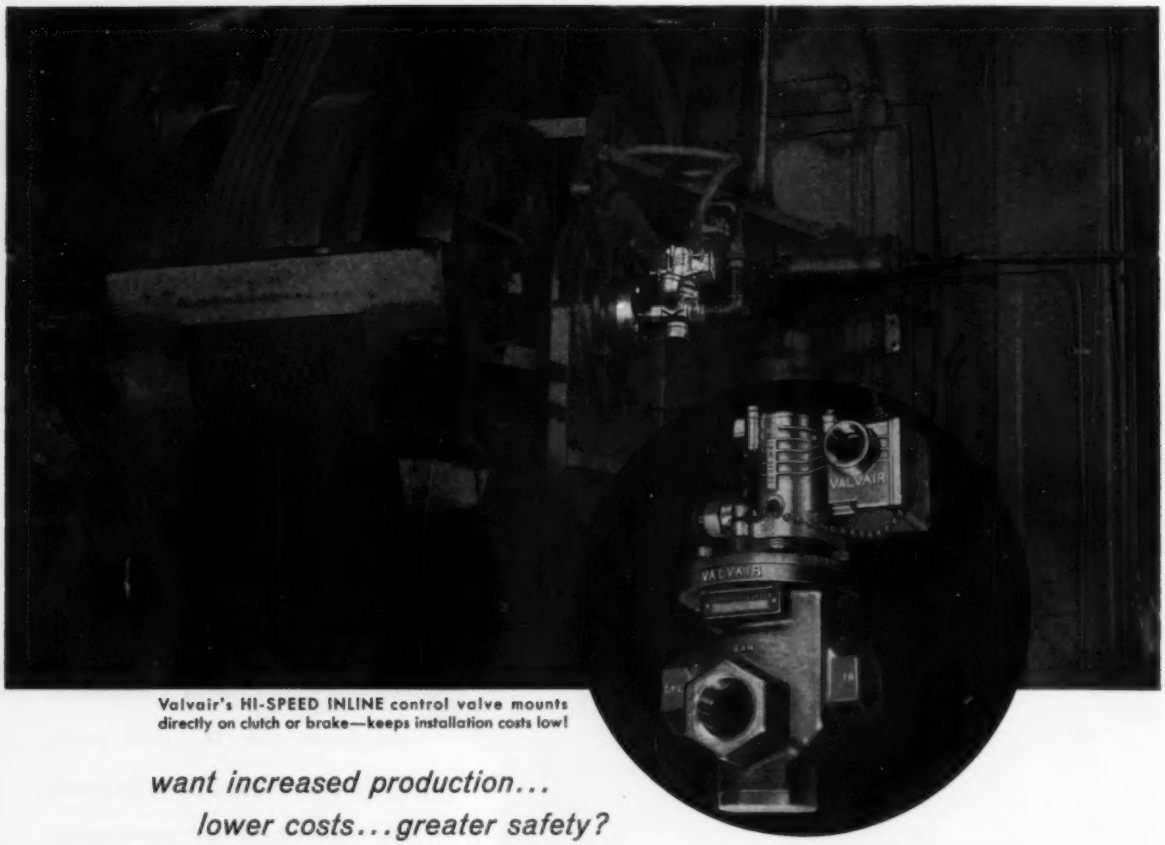
THE WORLD'S LARGEST
EXCLUSIVE MANUFACTURER
OF VIBRATORY PARTS FEEDERS

Peeco

PERRY EQUIPMENT & ENGINEERING CO.

ERIE, PA. • • • DIVISION OF AUTOMATION DEVICES, INC.

Circle 714 on Page 17



Valvair's HI-SPEED INLINE control valve mounts directly on clutch or brake—keeps installation costs low!

want increased production...
lower costs...greater safety?

use VALVAIR'S HI-SPEED INLINE VALVES

for instant-action control of clutches and brakes!

The split-second response of Valvair's pilot-operated HI-SPEED INLINE valves means shorter machine cycle time . . . more work per hour . . . more accurate cuts for high speed cut-offs . . . less clutch and brake slip . . . lower maintenance costs! And, precise control cuts machine set-up time . . . assures safer operation by minimizing drift.

Short travel, air cushioned poppet action is the HI-SPEED INLINE'S speed secret. Simple design assures multi-million cycle dependability . . . the valve has only 3 moving parts!

Built to Valvair's high standards, the HI-SPEED INLINE features cast Navy M bronze bodies, pilots built to JIC standards and fully interchangeable with your Speed Kings, solenoid coils guaranteed against burn-out for the life of the valve, plus molded Hycar poppet seals. Manual over-ride and integral junction boxes optional.

Valvair HI-SPEED INLINES *are available for immediate delivery from stock*, in sizes and types for every need. Specify them on new equipment . . . use them to replace obsolete valves now in service . . . one installation will convince you! Valvair Corporation, 454 Morgan Ave., Akron 11, Ohio.

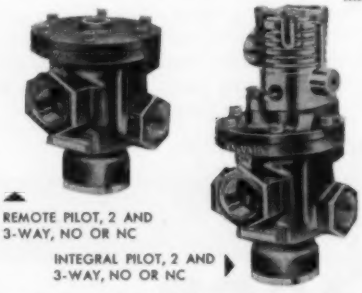
AA-5250

Find your nearest representative in the 'Yellow Pages'

Compare . . . and you'll buy

Valvair

Sizes range from ¼ to 1½ in. NPT. Solenoid pilot coils for ac or dc, any voltage. Working pressure, 10 to 200 psi.



REMOTE PILOT, 2 AND 3-WAY, NO OR NC

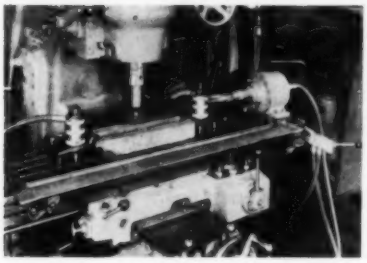
INTEGRAL PILOT, 2 AND 3-WAY, NO OR NC

Representatives in: Baltimore • Birmingham • Boston • Buffalo • Charleston, W. Va. • Chicago Cleveland • Cranford, N. J. • Dayton • Denver • Detroit • Eureka, Calif. • Grand Rapids Houston • Indianapolis • Kansas City, Mo. • Logansport, Ind. • Los Angeles • Louisville • Miami Milwaukee • Minneapolis • Muncie • New Orleans • New York • S. Pasadena • Philadelphia Pittsburgh • Portland, Ore. • St. Louis • Seattle • San Francisco • Syracuse • Montreal • Toronto Vancouver

mospheres charged with grain dust, carbon black, coal, or coke dust, and atmospheres containing metal dust, including aluminum and magnesium.

Unit consists of a low torque motor, gear reduction unit and an improved mounting arrangement. A rotating paddle, mounted on a flexible shaft, projects into the bin and is driven by a small motor mounted in a housing outside the bin. When material in the bin partially or entirely covers the paddle, the rotation of the paddle is stopped and the torque exerted by the motor actuates a limit switch in the motor housing. When material drops below the paddle, rotation is resumed and the switch returns to normal position. **Bin-Dicator Co.**, 209-13946 Kercheval Ave., Detroit 15, Mich.

Circle 461 on Page 17



Automatic Setup Clamps

Item 462

Units are capable of clamping work pieces to machine tables; clamping work pieces to a production fixture; locking two or more parts of a production fixture together; locking two or more mating parts of a work piece together, and exerting direct force as a small hydraulic ram, or press. Basic unit consists of an air control, hydraulic booster, and one of three models of clamping heads. Compressed air from the factory system is passed through a filter-lubricator to the *on-off* control valve. With the valve open, air enters the air-hydraulic booster, producing hydraulic pressure on the oil line. Boosters come in three sizes, and are capable of operating one, two or four heads. **Wilton Tool Mfg. Co. Inc.**, 9525 Irving Park Rd., Schiller Park, Ill.

Circle 462 on Page 17

with the LIPE Automatic MAGAZINE LOADING BAR FEED"

says Screw Machine Foreman Willis J. Forbes*

Up to six months ago, the record per-machine production in our department for a single day was 5760 pieces. Our best monthly average was 5300 pieces per day. We tried out a Lipe A.M.L. to feed one machine, turning at the same cutting speed as before. In the first full day of operation, the A.M.L.-fed machine matched our top monthly average by 1:25 P.M. . . . and ended the day at 4:00 P.M. with a production of 7823 pieces! It has continued to turn out that number daily, *for six months!*

Why? The Lipe A.M.L. feeds stock continuously: No repeat motion for feed-outs. No down-time for changing feed fingers, or for remnant disposal. No cutting air—and when you stop cutting air, you start cutting costs. That's why we are now equipping our department throughout with Lipe A.M.L. Bar Feeds.

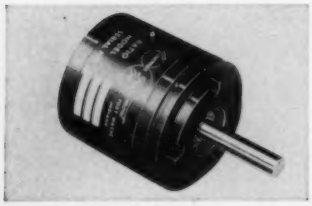
WRITE OR WIRE for a FREE Lipe Sales Engineering estimate of production increases, savings and amortization time of Lipe A.M.L. Bar Feeds in your production layout.

*Photographer's models and pseudonyms used to protect company identity and confidential information.

Lipe-ROLLWAY CORPORATION SYRACUSE 1, N.Y.

MACHINE TOOLS • HEAVY-DUTY AUTOMOTIVE CLUTCHES • PORTABLE POWER HACK SAWS

Circle 718 on Page 17



Precision Gear Heads

Item 463

Capable of use in servomechanical devices and other control systems, gear heads are designed for use with size 11 motors. Model 1384-GH (shown) is suitable for installations requiring short length at standard ratios and can withstand heavy duty applications. Model X-295 has an off-center shaft and ratios to 1000:1. Model X-507 has ratios to 3,000,000:1 and higher, with a low backlash. Model X-414 has internal stops to limit rotation, and a slip clutch which prevents damage to the motor or the gear head. **Bowmar Instrument Corp.**, 2408 Pennsylvania St., Ft. Wayne, Ind.

Circle 463 on Page 17

WALTER P. HILL

Tubular chair legs are produced at a rate of 1,440 pieces per hr on this Hill machine. Production savings in less than six months justified the machine purchase price.

HILL AUTOMATED MACHINES COMBINE PUNCH PRESS AND BENDING OPERATIONS

Now you can achieve significant production savings on tubular parts by combining punch press and bending operations on Hill fully-automated machines. Piercing, countersinking and flattening operations, as well as coining of weld projections can be combined with multiple bending in a single, versatile, high-speed machine.

These new horizontal punch press and multiple bending combination machines utilize unique press bending principles and hydraulic power systems to produce up to two and more parts at a time. They are ideally adapted to the production of tubular furniture, automotive and aircraft molding and trim, and will also handle angle, square or rectangular-section shapes.

If you produce 50 or 50,000 pieces a day, it will pay you to investigate Hill advanced designs. Send part specifications and production requirements for prompt quotations on cost-saving equipment.

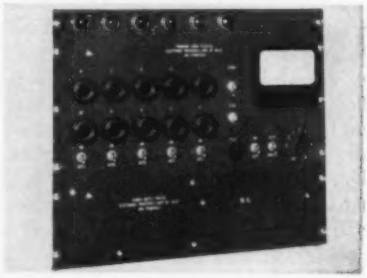
Write for this catalog giving complete information on Hill specialized hydraulic bending machines, double-end machines and extrusion equipment.

WALTER P. HILL

WALTER P. HILL, INC.

22183 Telegraph Road • Detroit 19, Michigan

Circle 717 on Page 17



Program Timer

Item 464

Timer independently controls the sequence and timing of several related operations of a machine or process. Model PT-157 is designed for rapid and accurate change of the time settings and controlling each operation and eliminates cam adjustments. It can control the *on* and *off* sequence of six different operations. More operations can be controlled by adding one switching comparator for each additional *on* and *off* operation. Setting can be varied as the cycle is in progress without interrupting the time cycle or the settings of other operations. Remote *start* and emergency *stop* switches are offered, and circuit wiring flexibility is provided by a wiring duct. **Electronic Processes Corp. of Calif.**, 2190 Folsom St., San Francisco 10, Calif.

Circle 464 on Page 17

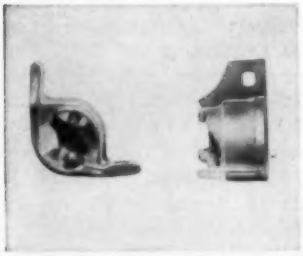
Automatic Roll Marker

Item 465

Device marks the end surfaces of production parts, such as bearing races, cups and cones, during the machining cycle on screw machines and other multiple-station machines. Automatic roll mark-

ers can be mounted on tool slides of machine tools and are adaptable to automatic equipment. Units are designed for direct in-line mounting in relation to true pitch diameter and can transfer numbers or characters from a conical marking die to a flat end face of the parts. Roll markers operate on the same centers as the part being machined and maintain constant alignment and accurate marking dimensions. **New Method Steel Stamps Inc.,** 149 Jos. Campau St., Detroit 7, Mich.

Circle 465 on Page 17

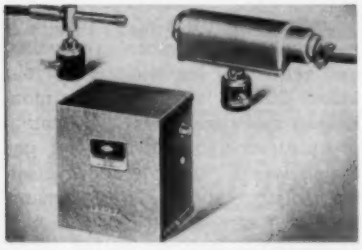


Fastener Receptacles

Item 466

Suitable for control panels and access openings Models 26R3-1 and 26R4-1 are for side and corner (shown) mounting of quick operating fasteners. Two mounting holes have increased mounting tolerance for low-cost production operation. Rivet holes on which receptacles are to be mounted can be prepunched by automatic means. Receptacles can accommodate 2600 and 2700 series type stud assemblies. **Camloc Fastener Corp.,** 22 Spring Valley Rd., Paramus, N. J.

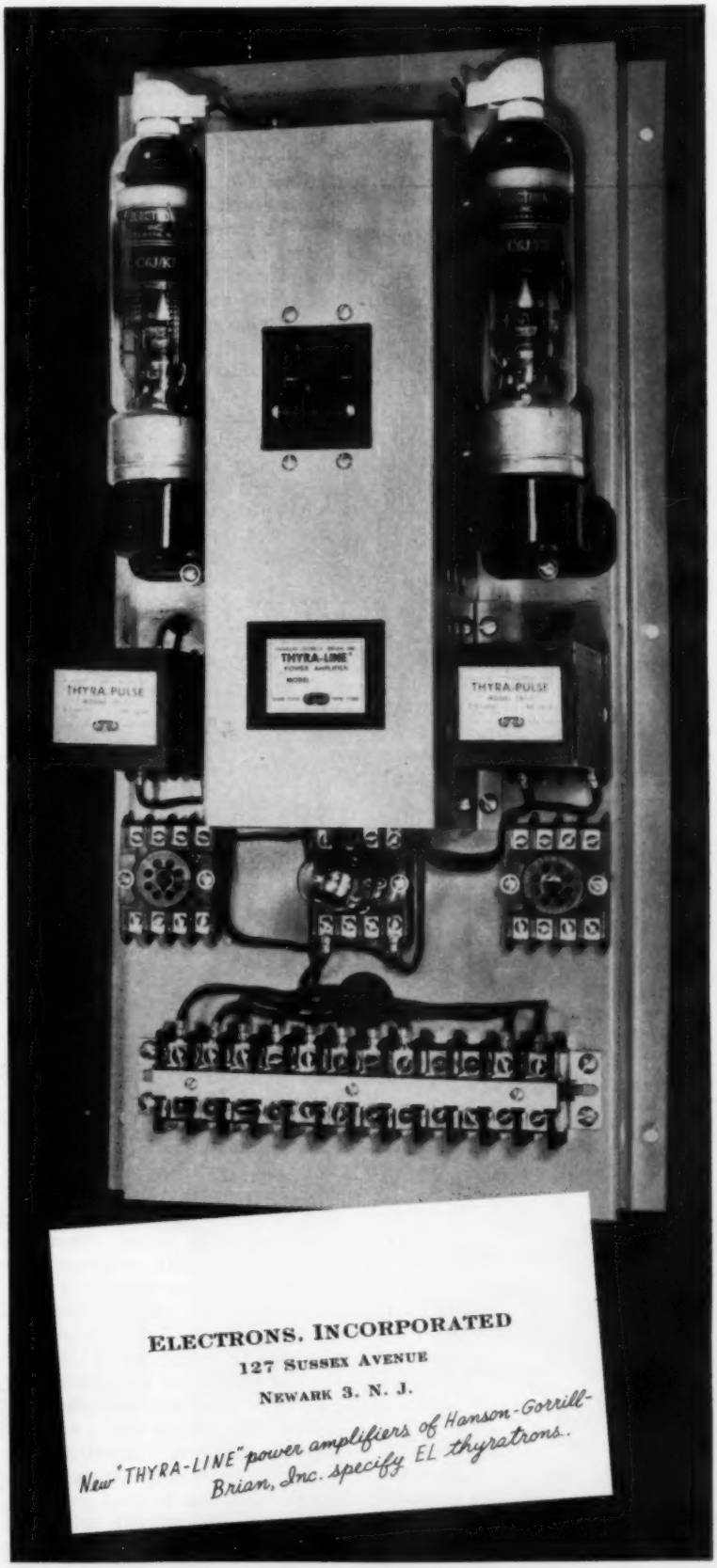
Circle 466 on Page 17



Photoelectric Controls

Item 467

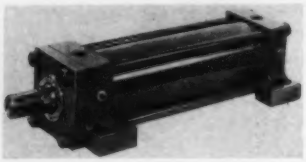
Equipment is capable of controlling a great variety of proc-



Circle 716 on Page 17

esses and systems within a plant. Model REC3 can count, inspect and regulate traffic without contacting the material or the equipment being controlled. The small size of the components allows easy installation. **Standard Instrument Corp., Div. Heat-Timer Corp.,** 657 Broadway, New York 12, N. Y.

Circle 467 on Page 17



Power Cylinders

Item 468

Devices are made for service at 2000 psi, or 3000 psi in nonshock installations. Cylinders are double-acting and can be furnished with precision adjustment cushions at either or both ends, without increasing length. Steel with 125,000 psi minimum yield strength is used for the tie rods. Cylinder barrel is cold-drawn seamless steel tubing honed to 10 mu in. finish and heads are machined from cold-finished steel bar stock. Cartridge assembly is replaceable as a complete unit or the bronze rod bushing and rod packing can be replaced separately. Cylinders are available in bore sizes from 1½ to 12 inches. The rod wiper is interchangeable with standard metallic scrapers. **Anker-Holth Div., Wellman Engineering Co.,** 2723 Connor St., Port Huron, Mich.

Circle 468 on Page 17

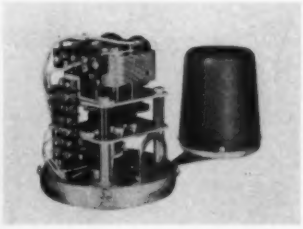
Flow Switch

Item 469

Instrument protects fluid-cooled industrial equipment such as tubes, transformers, and other electronic equipment; acts as a sentinel for lubricating supply to bearings, and gives automatic protection whenever the rate of flow approaches an unsafe rating.

Interlock operates on a differential of flow pressure across a nozzle, and the flow setting for the control can be changed by changing the orifice size in the nozzle. The electric switch on the unit makes or breaks contact in accordance with the movement of the lever arm and plunger that transmits the diaphragm action to the switch. Diaphragm action is due to a definite and predetermined pressure drop through the discharge nozzle, with the discharge of the nozzle designed to produce the proper pressure differential to meet the customer's flow and switch specifications. Operating pressures range from 5 psi to 150 psi. **Hays Manufacturing Co.,** 718 W. 12th St., Erie, Pa.

Circle 469 on Page 17

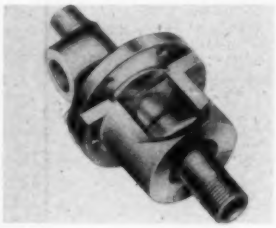


Shaft Mounted Gearmotor

Item 470

Unit includes a built-in potentiometer to provide remote indication and control for valves, variable speed drives, gates, jacks and variable displacement pumps. Control can be by dial, pushbutton (shown) or it can be automatic from limit switches, controllers or proportioning devices. Installation is made through use of a mounting shaft collar. Shaftrols are furnished with a torque arm to compensate for any runout present in the shaft. A wide range of operating speeds and torques is available by specifying the desired ratio of the 3 or 4 stage reduction gearing. Shaftrols can be furnished with built-in single or multi-turn precision potentiometers having a wide range of specifications. They can be used on single or 3 phase circuits with dripproof, totally enclosed or explosion-proof enclosures. **Jordan Co. Inc.,** 3235 W. Hampton Ave., Milwaukee 9, Wis.

Circle 470 on Page 17

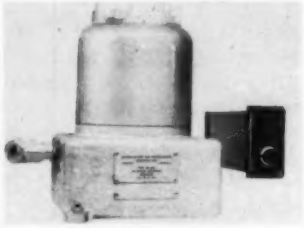


Rotary Joint

Item 471

Units are suitable for connections to rotating cylinders such as used on dryers, mills and presses. They operate efficiently at steam pressures up to 250 psi with temperatures up to 550F and speeds up to 1000 rpm. Rotary joint features flexible shaft alignment for easy installation, packless and self-lubricating bearing surfaces, and a low minimum turning torque. Design also allows the sealing members to function independently of the operating load. **Philips Sales Co.,** P. O. Box 417, W. New York, N. J.

Circle 471 on Page 17

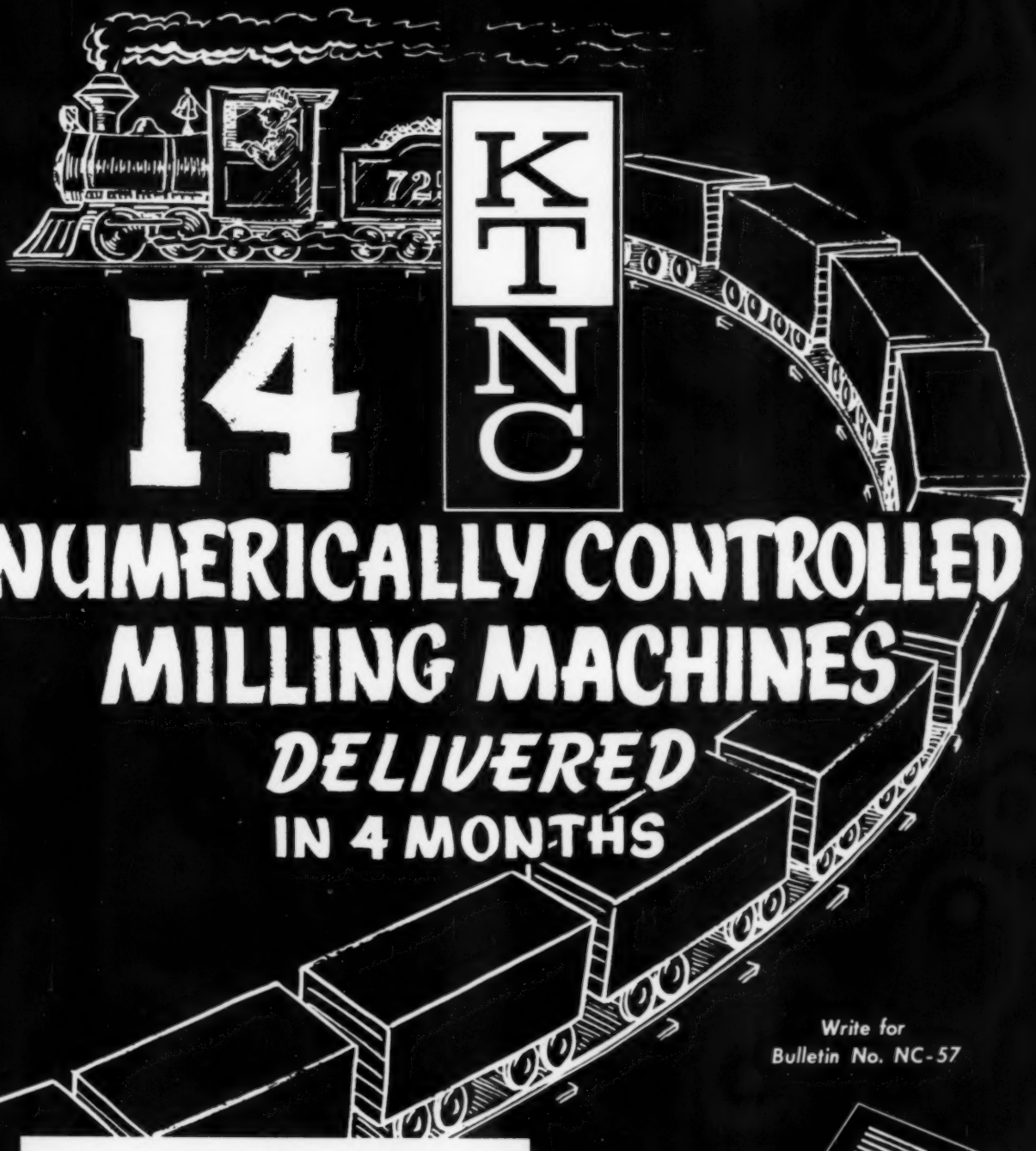


Moisture Monitor

Item 472

Instrument gives continuous measurement, remote recording, and control of low moisture levels. Model 26-310 is suitable for monitoring moisture content of instrument airstreams and natural gas transmission lines, or for recording moisture levels of feed streams in low - temperature distillation units and in polymerization units. Other applications include monitoring dehydrating towers in gasoline plants, monitoring the effectiveness of air dryers in process plants, and measuring water-vapor

Circle 764 on Page 17→



14 KTNC

NUMERICALLY CONTROLLED MILLING MACHINES

DELIVERED

IN 4 MONTHS

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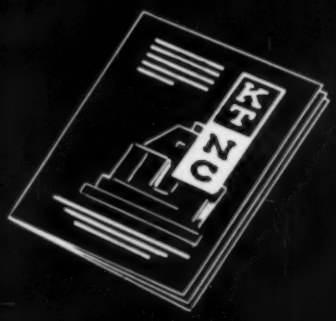


KEARNEY & TRECKER MILWAUKEE

KEARNEY & TRECKER CORP.
6784 West National Ave. Milwaukee 14, Wis.

AMERICAN MONORAIL

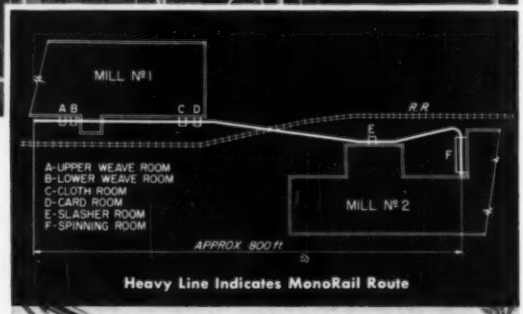
transports cars between 2 mills-

stops at ground and upper level stations.

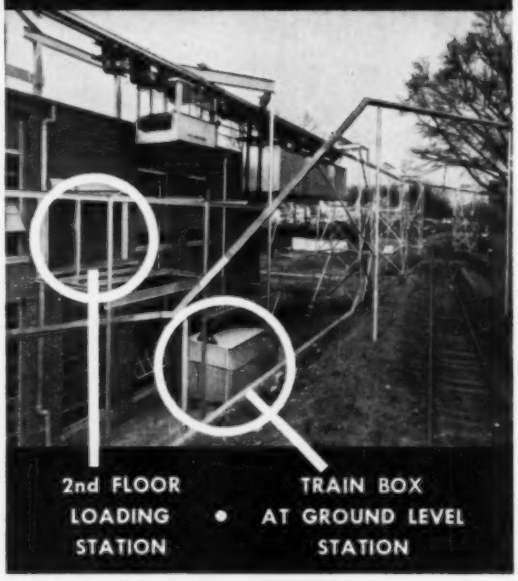
The equivalent of several elevator loads of material can be transported from building to building and from floor to floor by this modern materials handling system. Erected entirely out of doors, the MonoRail operates overhead, safely above railroad and all other traffic, and takes up no space at all inside the mills.

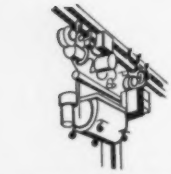
Loads transported consist of warp beams, boxes of filling quills, roving, trucks of drawing sliver and cloth. Approximately 132,000 lbs. from stations at each mill are transported during an 8-hour shift.

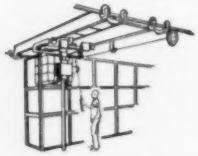
All operations can be controlled from the cab which is equipped with heaters, electric fans, windshield wipers, a gong and spotlights for night operation.

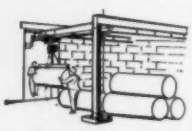


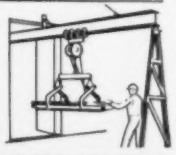
Heavy Line Indicates MonoRail Route




AUTOMATIC DISPATCH


STACKER CRANE


MANUAL MONORAIL


RETRACTABLE CRANE

Member of American Textile Machinery Association

For Power Driven Conveyors, Use Landahl Chainless Conveyors

AMERICAN MONORAIL COMPANY

OVERHEAD HANDLING EQUIPMENT

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(IN CANADA—CANADIAN MONORAIL CO., LTD., GALT, ONT.)

Circle 719 on Page 17

content of stored petroleum gas.

Engineering refinements incorporated in the basic design developed by E. I. du Pont de Nemours & Co. give accurate measurements down to less than 1 ppm. Analysis is done by continuously and quantitatively absorbing and electrolyzing all water present in a sample stream entering the instrument. The electrolysis current is used as an indication of water content. Heart of the instrument is the electrolysis cell, where the absorption and electrolysis take place simultaneously. The cell consists of a tube which has a pair of closely spaced platinum wires wound in a double helix on its inner surface. The space between these wires is coated with a viscous film of partially hydrated phosphorous pentoxide. A dc voltage is applied to the elements of the cell and the electrolysis current is monitored with a 10 or 50 mv potentiometric recorder. Equipped with an accurate flow regulator and sample flow-rate compensator network, the unit gives precise readings over the full-scale range from less than 1 to 1000 ppm by means of a 5-step attenuator. **Consolidated Electrodynamics Corp.**, 300 N. Sierra Madre Villa, Pasadena, Calif.

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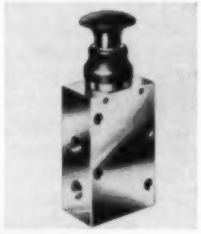
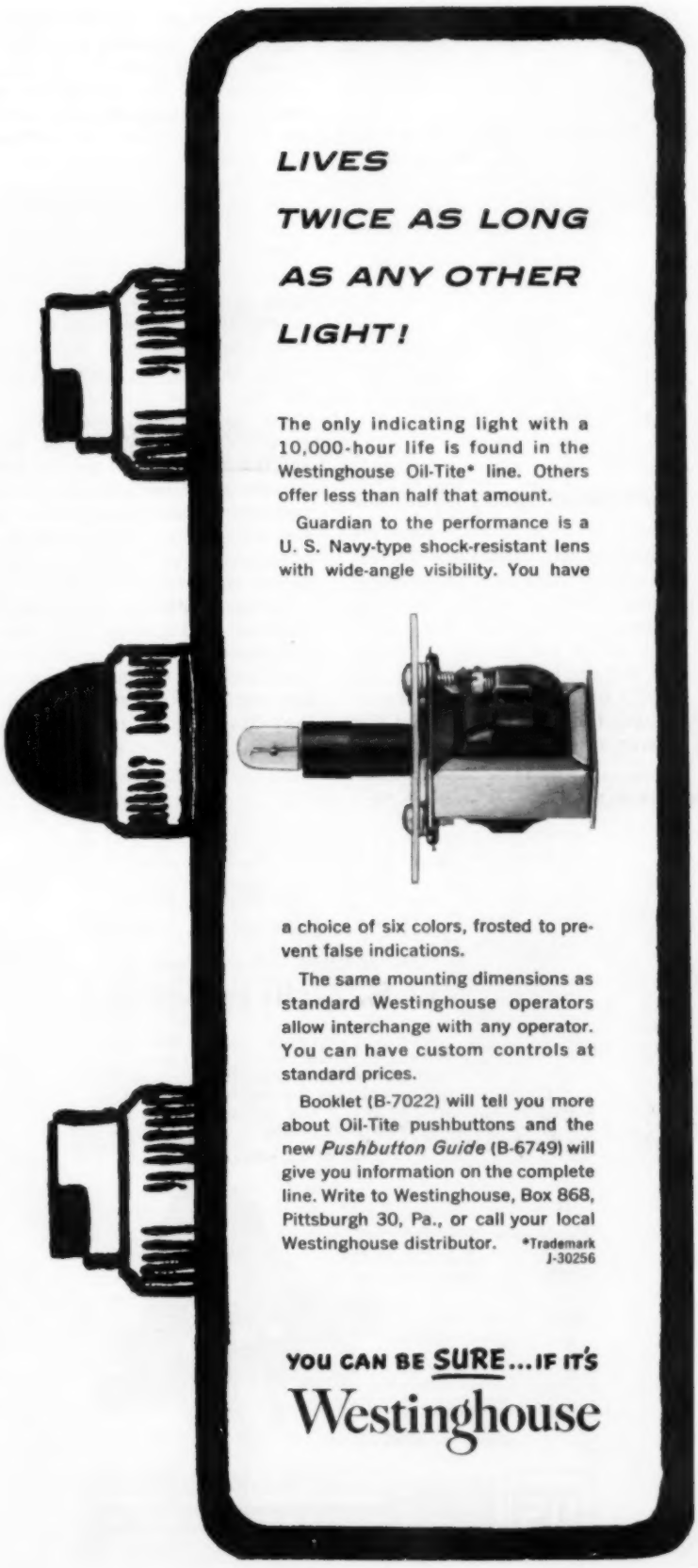


Air Control Valve

Item 473

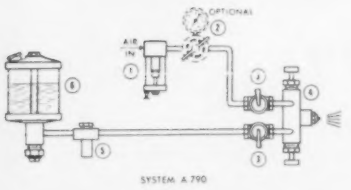
Design features a synthetic rubber boot which snaps in place around the valve stem, sealing all critical parts from dirt and abrasives, and increasing valve life. Valve is corrosion resistant due to use of aluminum, stainless steel and molded nylon. Basic unit has five optional actuating heads, palm button, ball cam, lever, locking lever, and mechanical link clevis. They can be interchanged in less than 30 seconds by removing and replacing two pins. Replacement


LIVES
TWICE AS LONG
AS ANY OTHER
LIGHT!
The only indicating light with a 10,000-hour life is found in the Westinghouse Oil-Tite* line. Others offer less than half that amount.
Guardian to the performance is a U. S. Navy-type shock-resistant lens with wide-angle visibility. You have
a choice of six colors, frosted to prevent false indications.
The same mounting dimensions as standard Westinghouse operators allow interchange with any operator. You can have custom controls at standard prices.
Booklet (B-7022) will tell you more about Oil-Tite pushbuttons and the new Pushbutton Guide (B-6749) will give you information on the complete line. Write to Westinghouse, Box 868, Pittsburgh 30, Pa., or call your local Westinghouse distributor.
*Trademark
J-30256
YOU CAN BE SURE...IF IT'S
Westinghouse

Circle 720 on Page 17

spools can be interchanged without disturbing the piping. Valves can be base, panel, or wall mounted, and can be used as a two-way or three-way valve. Device is built for 150 psi air operation and has ¼-inch pipe ports. **Hanna Engineering Works,** 1765 Elston Ave., Chicago 22, Ill.

Circle 473 on Page 17



Pneumatic Spray Systems

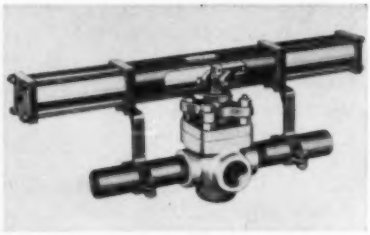
Item 474

Systems are applicable to operations or parts such as grinding, milling, drilling, tapping, reaming, sawing, punches and dies, sheet stock oiling, hot chains, cams, cables and die casting molds. In the gravity or syphon operated spray system (shown), oil is fed by gravity or is syphoned into the spray valve and the oil volume is adjusted by a needle valve on the spray valve. Adjustment of air pressure and air volume is combined into one needle valve control on the spray valve. An additional air pressure regulator can be added for better performance.

In the air operated spray system, oil is forced into the spray valve by air pressure. A pressure regulator on top of the tank allows setting of suitable pressure. A second pressure regulator controls the air pressure to the spray valve. In the pump operated spray system, oil is fed to the spray valve by a gear pump. The oil pressure can be adjusted by a suitable by-pass with control valve. An air regulator controls the air pressure to the spray valve. Oil and air volume for spraying is adjustable by individual needle valves on the spray valve.

Valves for these systems are the external mixing type that reduce objectionable fog to a minimum. They produce a round spray pattern and will atomize any liquid that flows, up to an oil of 1000 seconds S.U. viscosity at 100 F. Each spray valve is equipped with two needle valves, one to control the flow of air and the other to control the flow of oil. Each valve can be adjusted individually, or shut off entirely without disturbing the performance of the others. **Oil-Rite Corp.,** 2312 Waldo Blvd., Manitowoc, Wis.

Circle 474 on Page 17



Valve Operator

Item 475

New medium duty operators are adaptable to a wide range of control requirements, such as process cycling, safety, and automatic shut-offs. Model FM is a floating bar type operator incorporating two single-acting cylinders for use on valves requiring relatively low torques. Model TM has two double-acting cylinders, is designed for valves needing higher torques. A dual pipe-mounting bracket is available for both valve operators for field installation. Bonnet and flange type valve mounting brackets are also offered. **Ledeen Mfg. Co.,** 3350 N. Gilman Rd., El Monte, Calif.

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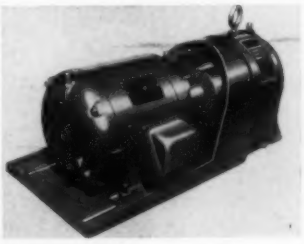


Speed Reducer

Item 476

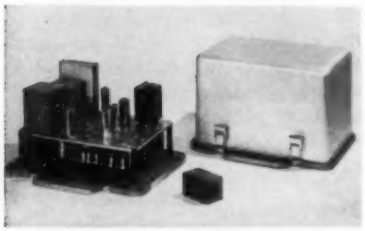
Gearmotor is especially suitable in automatic production lines because of the ease with which drive motors may be removed and replaced. Motor capacities range from 1 to 75 hp. Output speed

You KNOW where the holes will be . . . with
UNIVERSAL ADJUSTABLE
U.S. Drill Heads
"Shot gun accuracy" is for the birds. With U. S. Heads you pin-point your multiple-hole drilling *exactly*—position the drilling spindles for different patterns almost as easily and quickly as you read them from your prints.
Style U-1L Universal Adjustable Head provides 9" diameter drilling area. U. S. Heads cover a wide range—6" to 15" diameter drilling areas, drill sizes up to 1-1/16". Totally-sealed, lifetime-lubricated universal joints can be interchanged quickly without tools.
Immediate delivery on most sizes. Write today for complete specification data in new catalog No. AD-57.
We manufacture all types of adjustable, fixed center and individual lead screw tapping heads.
US DRILL HEAD
UNITED STATES DRILL HEAD CO.
BURNS STREET • CINCINNATI 4, OHIO

Circle 721 on Page 17

range is from 350 rpm to 7½ rpm. Speed reducer ratios up to 1478 to 1 can be changed with standardized drive components. A flexible coupling incorporated in the gearmotor absorbs misalignment and end float through the rocking action of the hubs in the sleeve. Double and triple reduction units are available in foot and flange mountings, vertical or horizontal. **Howell Electric Motors Co.**, Howell, Mich.

Circle 476 on Page 17



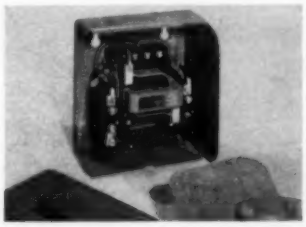
Telemetering Control Unit

Item 477

Designed for operation over telephone lines or cables with up to 20 db attenuation between associated transmitter and receiver, self-contained units are applicable to remote industrial control and recording. Some of the industrial applications are telemetering water levels of reservoirs and liquid levels in tanks; telemetering flow rates of water, oil, and gas in pipelines; status indication of switches, motors, and pumps at remote locations; and warning and alarm indications from remote locations.

When keyed by switches for control applications or pulse-width signaling transducers for metering, Model 55 transmitter provides two independent signaling tones in the frequency range 2.8 to 100 kc. Frequency is precisely controlled by interchangeable plug-in networks for each channel. Receiver provides two independent regulated outputs up to 20 and 50 ma for recording transmitted data. Plug-in relays can control up to 1 hp motors without the need for auxiliary contactors. The networks permit channel spacing closer than 1.5 per cent in frequency. This allows more than 200 separate control channels over one telephone line using frequencies between 3 and 100 kc without interfering with the use of the line for normal voice communication. **Moore Associates**, 2628 Spring St., Redwood City, Calif.

Circle 477 on Page 17



Magnetic Motor Starter

Item 478

Device can be applied to machine tools, pumps, hoists, blowers, saws, compressors, mixers, packaging machinery, and similar items. Components are constructed on a snap-slide principle and contacts can be inspected in seconds, without using tools. By turning a knob on each of the two overload relays, the overload trip setting can be adjusted up to ± 15 per cent of nominal heater rating, allowing quick adjustment to meet

PRESET COUNTER
By FREED

The Freed Model 2020 Preset Counter is designed for low cost reliable counting applications, where accuracy and maintenance-free operation is required.

Cold cathode counting and trigger tubes, with simplified circuits, are used throughout which assure years of trouble-free counting service and low-power consumption.

Model 2020 is a 4-digit single preset counter capable of controlling any operation that is repeated up to 9,999 times. Any number from 1 to 9,999 may be preset on the 4-digit selector switches. When the preset total has been reached, the counter will provide an output pulse and close contacts on a relay. These outputs may be used simultaneously or separately to stop machines, actuate control signals, or trigger additional equipment.

SPECIFICATIONS

Maximum Count: Four digits — 9,999
Maximum Counting Rate: 300,000 counts per minute
Input Sensitivity and Waveform: Not critical
Outputs: Relay contact 10 Amperes Pulse output 50 volts
Size: 8 x 6 x 12 inches
Weight: 11 pounds
Power: 25 watts 105-125 volts, 50-60 cycles
Price: $425.00

FREED ALSO MANUFACTURES TOTALIZING, PRESET, AND BATCHING COUNTERS

SEND FOR COMPLETE INFORMATION
FREED TRANSFORMER CO., INC.
1705 Weirfield Street
Brooklyn (Ridgewood) 27, N. Y.

Circle 722 on Page 17

FREE SELECTION CHART for AGASTAT® time delay relays

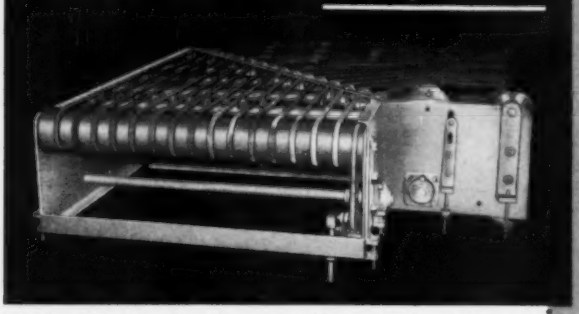
Now you can select exactly the right Agastat time delay relay for your particular timing need—in a hurry. This free selection chart lists data on every popular model in the Agastat line—the most complete line of pneumatic time delay relays in the industry. They're adjustable for timing from 0.1 second to 10 or more minutes, unaffected by voltage variation, dustproof, light, and mountable in any position. And there's an Agastat model to precisely fit your requirements, including two-step, electrical interlock and double head units. A glance at the free selection chart tells you which model to order.

Write for your free copy to Dept. A26-1123

AGA DIVISION
Elastic Stop Nut Corporation of America
1027 Newark Avenue, Elizabeth, New Jersey
Pioneers in pneumatic timing.

Circle 723 on Page 17

NEW STEWART-TURN
the 90° turn that really works!

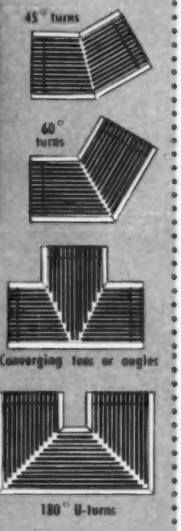


Turning 90° corners is no longer a problem or bottleneck in material handling systems. The unique Stewart-Turn moves material around corners as easily as in a straight line! No rollers to stick, tight corners to jam or deflectors to damage the material being moved. Never before has this been possible!

The Stewart-Turn is a series of narrow-faced belts, running in grooved pulleys, banked for constant contact with the material in motion. A slight differential in speed between the bank of belts produces a positive turning action, with belts spaced to carry small as well as large or long articles. Belt friction reaction to turning has been eliminated.

Stewart-Turns, as well as all Stewart-Glapat material handling equipment and conveyors, are CUSTOM DESIGNED TO YOUR JOB. If you are looking for advanced engineering thinking for your material handling or automation problems, WRITE STEWART-GLAPAT TODAY, and ask for complete details on the sensational, new Stewart-Turn!

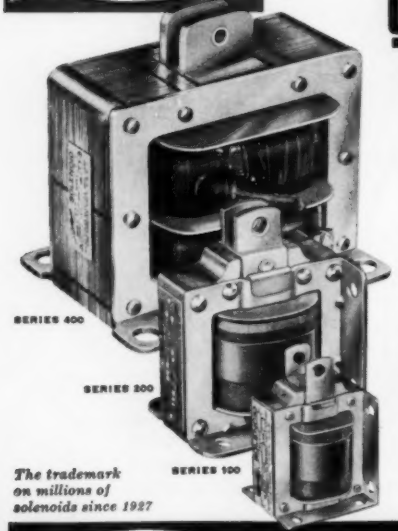
A few other applications of versatile Stewart-Turns.



STEWART-GLAPAT Corporation
1645 Moxahala Avenue, Zanesville, Ohio

Circle 724 on Page 17

WesCo **has the AC solenoids you need... in the quantity you need!**



The trademark on millions of solenoids since 1927

WESCO's famous Series 100, 200 and 400 AC solenoids—75 models in all—are immediately available in small or large quantities! One of these designs may fit your requirements. If not, WESCO engineers will design a special solenoid for your application. Inquire now.

WesCo designs and manufactures aircraft solenoids for military and commercial application. Write for complete catalog.

WesCo **WEST COAST ELECTRICAL MFG. CORP.**

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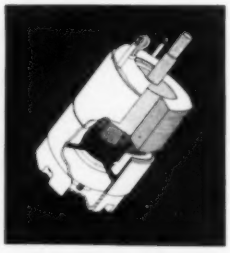
Circle 725 on Page 17

special application requirements in areas with varying temperatures.

All wiring on the starter, including work on interlocks and overload relays, can be done in front of the unit. Removable sides provide greater wiring space and speed installation. Leads go directly to all line terminals at the top and from all load terminals at the bottom. The shape of the contacts, design of the base support, and horizontal closing motions reduce bounce, increase contact tip pressure, and lessen the chance of contact welding. Contacts can be changed from normally open to normally closed without extra parts. A pushbutton or selector switch, overload relay, up to three auxiliary contacts, or a differently rated coil can be added within the same enclosure. Units are available in Size 0 rated up to 5 hp at 440v, and Size 1 rated for 10 hp at 440v. They come in contactor, nonreversing, combination, reversing, and multi speed forms. **General Electric Co.**, Schenectady 5, N. Y.

Circle 478 on Page 17



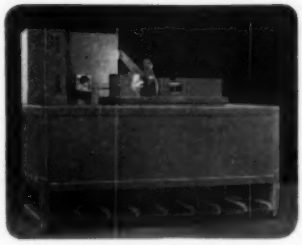
Mechanical Brake Motor

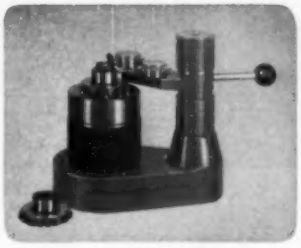
Item 479

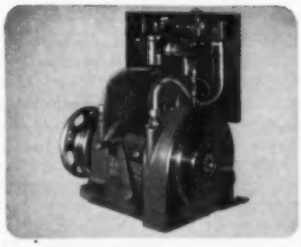
Machine is designed for quick releasing, fast braking, high braking torque, precision stopping, braking overhauling loads, as a holding brake, or hoist brake, and to stop motor coasting between operations. Magnetic field of the stator releases the brake when starting and the permanent magnet applies the braking force when current is turned off. Motor is constructed without coils and solenoids, increasing brake life and reducing maintenance. **Cleveland Electric Motor Co.**, 5213 Chester Ave., Cleveland 3, Ohio.

Circle 479 on Page 17

a single responsible source of creative engineering and manufacturing







For more than half a century, people with ideas or troubles have found that Garrison usually offers them a prompt solution at a price they can afford.

Our development of automated gear chucks several years ago is typical. A machine tool builder's engineer visited our plant and outlined the requirements for output and accuracy. A few days later we submitted our final layout of a package unit which met all requirements and has since proved itself by production records covering millions of finished parts in many plants.

Another firm explained that their best opportunity for cost reduction lay in assembly rather than production. Could we produce one machine that would rapidly inspect and sort various types of parts into eight categories—and deliver it in time to meet their schedules? Within ten days we started fabrication of the machine.

A leading automobile manufacturer needed a rugged inspection fixture for shop use to check gears at various stages in production in order to eliminate rejects promptly and signal the need for a correction in machine settings. They suggested that we use our production chucks as the basis for their inspection fixture. This use of our production chucks as gages in quality control programs is, obviously, a compliment to the workmanship and standards which are routine in our plant.

When a special machine required dimensional stability and tapered plain bearings to achieve accuracy and finish beyond anything available, we developed THERMAL CONTROL. It is available to any individual or firm on a very liberal license plan.

A manufacturer of fuel injection units encountered difficulties inspecting parts which had to be held to tolerances of a few millionths—and the problem became more difficult (quite naturally) when the operation was transferred to an air-conditioned gage laboratory. We quickly ended the difficulty by supplying a THERMO-LAB which is a necessity for laboratory precision operations of manufacture, inspection and assembly.

If you have a problem or an idea—and you want results at a price you can afford—contact us.

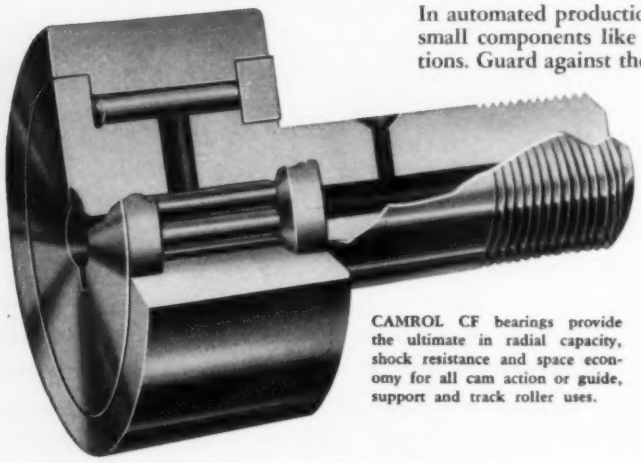
GARRISON MACHINE WORKS, INC.

DAYTON 4, OHIO U.S.A.

Circle 726 on Page 17

AUTOMATION TIPS by McGill

CAMROL® bearings ideally suited to anti-friction requirements of automated machinery

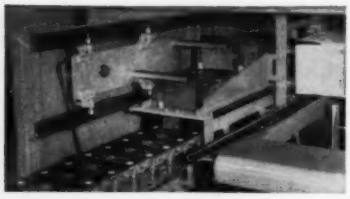


CAMROL CF bearings provide the ultimate in radial capacity, shock resistance and space economy for all cam action or guide, support and track roller uses.

In automated production, even the inefficiency and faulty operation of small components like a cam follower unit can cause costly interruptions. Guard against these failures by specifying CAMROL cam followers. Their quality insures dependability. Their design simplifies lubrication, easily accommodates critical loads and provides low starting and running friction.

Over 20 years of engineering development has gone into the McGill bearing — the first commercial full-type roller bearing cam follower. McGill has employed the advantages of these years of application experience to improve the design and build performance extras into the CAMROL CF, CYR and sealed SCF and SCYR series bearings. All are available in a wide range of standard sizes.

The applications cited below are just a few of the many instances where CAMROL bearings are adding to the dependability of automated machinery.

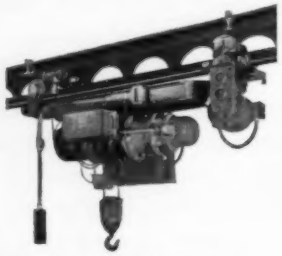


Camrol CF bearings cut power requirements on J. L. Ferguson Co. packaging machines

Used as load-carrying cam followers and as guide rollers in PACKOMATIC packaging machinery, McGill CAMROL CF bearings have brought several desirable advantages to J. L. Ferguson Company in the eight years this firm has relied on CAMROL bearings.

The CAMROL CF bearings eliminate wear by reducing friction. This reduces power requirements and smooths the operation of these machines. The CF bearings are standard, cost less and are more easily applied than previous assemblies.

For trouble-free operation, up to 50 bearings per machine are now used by this company.

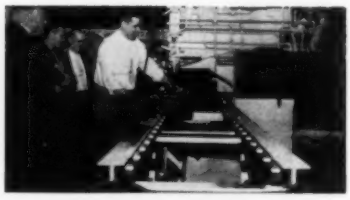


Cleveland Tram Rail guides motor heads on McGILL Camrol Bearings

Motor-driven electric hoist carriers made by the Cleveland Tramrail Division of the Cleveland Crane and Engineering Company, incorporate McGill CAMROL Cam Follower bearings as side guide rollers for the motor head.

Replacing spring loaded friction type bolt or roller units, the CAMROL cam followers provide dependable, free running operation of the carrier assembly and provide simplicity of mounting and lubrication with trouble-free performance.

Bearing performance has been most satisfactory through almost six years of use.



Camrol CF bearings provide friction-free track rollers for automatic mold blower

McGill CAMROL CF rollers are used as track rollers to form a mold conveyor in the Beardsley & Piper MBS-20 Mold Blower. The CAMROL CF bearings replaced built up friction rollers in this application. Although the duty here is rather light and the speeds slow, the cam follower bearing provides less starting and running friction. This helps speed the even flow of work from the machine, which must be fast and automatic. The compact unit, with integral stud, simplifies assembly and lubrication. Availability of a standard bearing is more convenient and less costly.

SEND FOR CATALOG 52-A

Insure performance with McGILL®

MULTIROL® GUIDEROL® CAMROL
Precision Needle Bearings

McGILL MANUFACTURING COMPANY, INC., 401 N. LAFAYETTE ST., VALPARAISO INDIANA

catalogs and literature

Latest automation information. For copies use card page 17.

Data Automation System

Remington Rand, Div. of Sperry Rand Corp., 315 *Fourth Ave., New York* 10, *N. Y.*—79 *page handbook*—Features of the new Univac II which stores up to 120,000 characters are explained in Catalog U 23. The manual contains five sections; description and illustrations of all available equipments and their function; a non-technical guide to the binary number system and the seven-place code of the Univac II system; a technical description of how the Central Computer is organized functionally; an explanation of the system's entire repertoire of instructions; and illustrations of how the computer responds to special conditions.

Circle 480 on Page 17

Brakes & Clutches

Warner Electric Brake & Clutch Co., Beloit, Wis.—8 *page bulletin*—Various types of brakes and clutches are described including electric brakes, clutch-brakes and miniature brakes and clutches. Advantages and features are noted and the controls explained in Bulletin WEB 6292.

Circle 481 on Page 17

Versatile Machine Tools

Baker Brothers Inc., Toledo 10, *Ohio*—8 *page bulletin*—Retooling of basic machines for different machining operations is the subject of Bulletin 117. Illustrations show the machine and components needed for milling, drilling and reaming.

Circle 482 on Page 17

Production Line Conveyors

Arrow Products Inc., S. Ferry St., Grand Haven, Mich.—4 *page pamphlet*—Cleated belt power units for conveying scattered parts to tote boxes are described. Specifications are given and features of the unit illustrated. Other types of material handling equipment are discussed.

Circle 483 on Page 17

Straightening Units

Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.—12 *page booklet*—Four types of straightening machines are covered in Bulletin 820-T-5; roll feed with direct pinion drive, spindle driven roll, back tension units for rolling mill operations, and custom engineered units. Various models with adjustments are illustrated, and specifications for standard straighteners noted.

Circle 484 on Page 17

Jet Mist Generator

Arrow Tools Inc., 1900 *S. Kostner Ave., Chicago* 23, *Ill.*—4 *page pamphlet*—A system for application of coolants and lubricants to machine tool cutting and forming operations is discussed in Bulletin MG-1056. Features of the system are noted, and illustrations of various applications included.

Circle 485 on Page 17

Air/Hydraulic Cylinders

Tom Thumb Div., Pneumatic-Hydraulic Development Co., Ft. Wayne, Ind.—4 *page pamphlet*—Engineering data on miniature size air and hydraulic cylinders are given. Bore sizes are noted and schematic drawings on various models included.

Circle 486 on Page 17

Closed Circuit TV Systems

Radio Corp. of America, Dept. TV-1056, Bldg. 15-1, *Camden* 2, *N. J.*—28 *page handbook*—Equipment and systems for TV service in medical, educational, industrial and business fields are described. Applications of the equipment are illustrated. Also noted are signal distribution systems, control consoles, associated studio equipment and special effects equipment for production of split screen, dissolves and other professional programming effects.

Circle 487 on Page 17

Screwdrivers/Nutrunners

Chicago Pneumatic Tool Co., 6 *E. 44th St., New York* 17, *N. Y.*—36 *page handbook*—Data on screwdriver-nutrunner drives, aids in explaining the principle of operation and the proper application of Magnamatic, direct drive, and stall torque impact types of torque-limiting clutches. Types of drives in the multi-spindle motor units are described and some of the models illustrated in Bulletin 580-1. Schematic drawings and performance charts are also included.

Circle 488 on Page 17

Small Box Gluer

International Paper Box Machine Co., 315 *Main St., Nashua, N. H.*—6 *page pamphlet* — Balanced prefold gluer designed for handling small boxes is described. Design features of Model 6F-X are illustrated and explained. Specifications are noted and a schematic drawing included.

Circle 489 on Page 17

Motor Pulleys

Reeves Pulley Co., Div. of Reliance Electric & Engineering Co., Columbus, Ind.—8 *page bulletin*—Variable speed motor pulleys are discussed and illustrated and design features noted in Bulletin V-563. Specifications and schematic drawings are included.

Circle 490 on Page 17

Strapping Machines

Gerrard Steel Strapping Div., U. S. Steel Corp., 2915 *W. 47th St., Chi-*

cago 32, Ill.—4 page pamphlet—Booklet covers two sizes of machine—large and standard openings. Illustrations show various applications and design features.

Circle 491 on Page 17

Tracer Control

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.— 12 page booklet—Tracer controls for manual and automatic lathes are described in Bulletin 1171-AGR. Design features and operation of units are explained, and illustrative applications included. Engineering information on various models is also given.

Circle 492 on Page 17

Data Processing Applications

Friden Calculating Machine Co. Inc., Commercial Controls Corp. Subsidiary, 1 Leighton Ave., Rochester 2, N. Y.—24 page handbook—Integrated data processing applications involving an automatic writing machine and other tape-operated machines which perform such functions as order invoice writing, purchase order writing and accounts payable are described. Flow charts are given and various models illustrated.

Circle 493 on Page 17

Conveyors

Logan Co., Louisville 6, Ky.—40 page handbook—Vertical conveyors, slat conveyors, chain conveyors and spiral chutes are described in Bulletin 36. Installation photos showing gravity and power conveyors and their application to present day methods of flow operation and automation are included. Conveyor accessories and storage equipment are also noted.

Circle 494 on Page 17

Instrumentation & Control

Hays Corp., Michigan City, Ind.—12 page booklet—Instrumentation problems such as pressure, flow, temperature, level and gas analysis are discussed in Bulletin 57-687-297. Applications of these control systems are given and features explained. Illustrations showing various units are included.

Circle 495 on Page 17

Bending Machines

Pines Engineering Co. Inc., 601 Walnut St., Aurora, Ill.—24 page handbook—Basic bending principles are explained in Catalog 356. Various applications in bending tubing, pipes, extrusions and rolled sections, and different tooling setups are illustrated. Design features and standard accessories are noted and a section describing bending machines for the aircraft industry is included.

Circle 496 on Page 17

Magnetic Drive

Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis 13, Minn. —2 page pamphlet—Magnetic drive unit, an eddy current clutch device which provides ac speed changing and automatic speed control, is outlined in detail in Bulletin 4400-PRD-243. Selection charts for torque loads for various models are included.

Circle 497 on Page 17

Electric Motors

Sterling Electric Motors Inc., 5401 Telegraph Rd., Los Angeles 22, Calif. —12 page booklet—Line of standard motors is described. Application of these motors is given, design features explained, and data for selecting correct motor is included.

Circle 498 on Page 17

Coated Abrasive Belting

Behr-Manning Co., Div. Norton Co., Troy, N. Y.—24 page handbook—Line and station abrasive belt polishing and platen grinding with abrasive belts are a few of the applications described. Drawings showing how coated abrasive rolls are used in machine tools and the suitability of centerless grinding with belts are included. Numerous photos of various applications are given.

Circle 499 on Page 17

Pallet Loader-Unloader

Materials Handling Section, Food Machinery & Chem. Corp., Riverside, Calif.—10 page bulletin—Combination machine which loads and unloads at the same time, handles wood cases, barrels, and returnable containers is described. Features and specifications are noted and illustrations showing various applications of the machine are included.

Circle 500 on Page 17

Continuous Weighing System

Bell Automation Corp., Div. of Bell Aircraft Corp., 749 Monroe Ave., Rochester 7, N. Y.—4 page pamphlet —System for weighing materials electronically on a conveyor belt is discussed. Features are noted and three-fold function of the system is explained.

Circle 501 on Page 17

Plating and Processing

Frederic B. Stevens Inc., 1800 Eighteenth St., Detroit 16, Mich.— 16 page booklet—Illustrative booklet describes plating and processing installations for anodizing, phosphating, printed circuit plating, barrel nickel plating, cleaning and pickling, zinc and cadmium plating. Highlights of these installations, from original stories published in metalworking magazines are included.

Circle 502 on Page 17

Flexible Couplings

Link-Belt Co., Dept. PR, Prudental Plaza, Chicago 1, Ill.— 12 page bulletin—Data on standard flexible couplings, spacer couplings, mill motor couplings, and single engagement couplings are given in Bulletin 2775. Selection information, application of flexible couplings and bore sizes are covered.

Circle 503 on Page 17

Miniature Bearings

Minature Precision Bearings Inc., Keene, N. H.—24 page catalog— Miniature ball bearings and their application in the field of electronics, instrumentation, and office equipment are discussed. Bore dimension charts on radial types, including radial retainer, flanged radial retainer, and single and double shield radial retainers, are given. Load ratings, limiting speeds, mounting procedure, lubrication, handling, and packaging of miniature bearings are also noted.

Circle 504 on Page 17

Dry Material Feeder

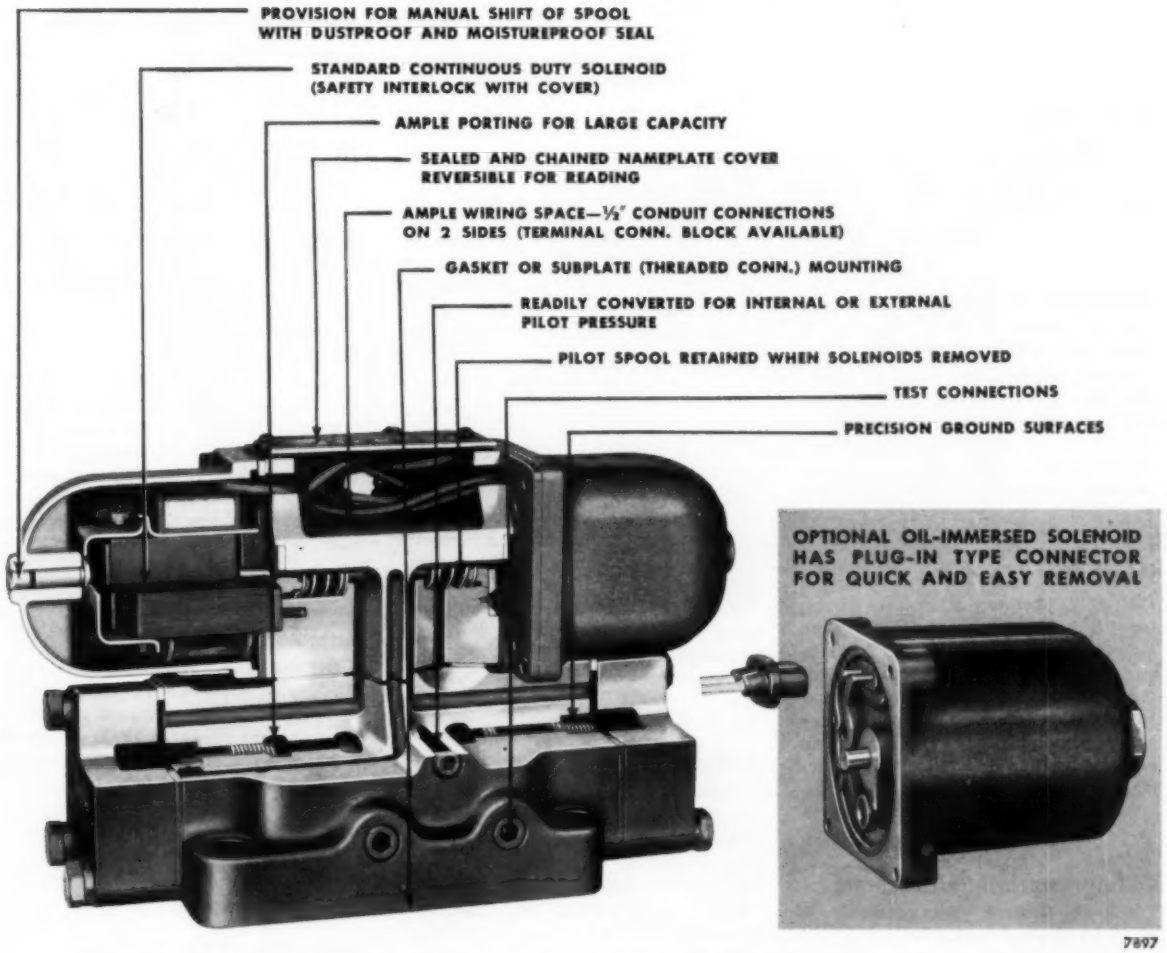
Omega Machine Co., Div. of B-I-F Industries Inc., 345 Harris Ave., Providence, R. I.—4 page pamphlet—Advantages of belt Gravimetric feeder for continuously weighing and feeding dry materials at high rates are described in Bulletin 35-N62. Principles of operation are noted, accessories given, and dimensions for Model 37-20 included.

Circle 505 on Page 17

Gap Presses

Verson Allsteel Press Co., 9300 S. Kenwood Ave., Chicago 19, Ill.—16 page booklet—Data on gap presses from 75 to 500 tons capacity is given in Catalog GP-57. Specifications for various models are noted, and details

Only VICKERS® DIRECTIONAL VALVES Have All These Features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AMPLE PORTING FOR LARGE CAPACITY
SEALED AND CHAINED NAMEPLATE COVER REVERSIBLE FOR READING
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PILOT SPOOL RETAINED WHEN SOLENOIDS REMOVED
TEST CONNECTIONS
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OPTIONAL OIL-IMMERSED SOLENOID HAS PLUG-IN TYPE CONNECTOR FOR QUICK AND EASY REMOVAL
7897

REDUCED DOWN-TIME
LONGER SOLENOID LIFE
LESS MAINTENANCE
EASIER INSTALLATION

Vickers hydraulic 2- and 4-way valves provide the optimum in directional control. They are compact, versatile, and are designed for heavy duty, continuous and rapid cycling operation on all types of industrial machinery. More than a decade of application experience and years of research and development back all the valves' features.

Seven spool types satisfy a wide variety of circuit needs and operate at pressures to 3000 psi. Optional oil-immersed solenoids operate cooler, increasing service life 20 to 30 times.

Installation is simplified with ease of wiring and a minimum of piping. The valves are available for gasket or sub-plate mounting. Mounting position is unrestricted except in "no-spring" models. The optional oil-immersed solenoid has a plug-in type connector and is available in all standard voltages. Field modification of existing units can be made to incorporate heavy-duty, oil-immersed solenoids.

The valves conform to JIC Standards and are available in ⅛" and ¼" direct solenoid operated models . . . ¾", 1¼", 2", and 3" solenoid controlled pilot operated models. These valves cover the flow range from 1.25 gpm to 320 gpm.

For further information, write for Installation Drawing I-182412.

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
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on the design and construction explained. Also included are illustrations of company's other products.

Circle 506 on Page 17

Numerical Control

Pratt & Whitney Co. Inc., Charter Oak Blvd., W. Hartford 1, *Conn.*—12 *page booklet*—Numerical control, an automatic means of translating blueprint data into machine positioning, is explained in detail. Schematic drawings are included and illustrative examples given. The Electrolimit measuring system used in the machines is described.

Circle 507 on Page 17

Conveyors & Storage Racks

A. J. Bayer Co. Inc., Slauson & Santa Fe Aves., Los Angeles, Calif. —4 *page pamphlets*—Two pamphlets describe gravity roller conveyors and portable wheelway conveyors. Specifications are noted and various applications explained. Construction features are also covered.

Circle 508 on Page 17

Punch Press Feeds

H. E. Dickerman Mfg. Co., 321 *Albany St., Springfield, Mass.*—10 *page bulletin*—Adaptability of the feeds to any type of press is explained. Numerous models are described and specifications given for them. Operating principles are also discussed and typical feed applications illustrated.

Circle 509 on Page 17

Coding/Imprinting Attachment

Adolph Gottscho Inc., Hillside 5, *N. J.*—4 *page pamphlet*—Coding and imprinting attachment for wrapping and bundling machines is described in Bulletin RIN-6. Illustrations showing applications of the attachment from placement of a small code-date on a preprinted wrapper to printing descriptive copy on 5 sides of a bundle overwrap are included.

Circle 510 on Page 17

Blast Cleaning Machines

Wheelabrator Corp., 1109 *S. Byrkit, Mishawaka, Ind.*—34 *page handbook* —Cleaning and finishing processes are discussed in Bulletin 105-D. Illustrative examples of the air type, airless type and wet type blast cleaning are given. Case histories of various companies, their special cleaning problems, and how they solved them are also noted.

Circle 511 on Page 17

Heat/Fluid Techniques

Selas Corp of America, Dresher, Pa.—24 *page handbook*—Services and facilities of company are explained in Bulletin S-1053. Description of organization's methods from definition of basic problems to production of a finished system is given. Numerous illustrative examples of the application of precise heat and fluid processing techniques to materials are included.

Circle 512 on Page 17

DC Motors

Allis-Chalmers, Milwaukee 1, *Wis.* —6 *page pamphlet*—Motors from ½ thru 200 hp, and motor-generator sets up to 200 kw output are described in Bulletin 53 B 8424. Various models and frame sizes are covered, and construction features discussed in detail.

Circle 513 on Page 17

Basic Switches

Micro Switch Div., Minneapolis-Honeywell Regulator Co., Freeport, Ill.—32 *page catalog*—Encased aircraft switches, metal-covered hermetically sealed switches and high temperature switches are described in Catalog 78. Electrical data and operating characteristics for switches, auxiliary switch actuators and terminal enclosures are also given.

Circle 514 on Page 17

Pellet Mill

Pellet Mill Div., Sprout-Waldron & Co. Inc., Muncy, Pa.—4 *page pamphlet*—Data on machine which forms powdered and dusty material into compressed pellets is given in Bulletin 182. Applications are discussed, specifications and construction features noted, and a schematic drawing given.

Circle 515 on Page 17

Dust Eliminators

Schmieg Industries Inc., 23930 *Sherwood, Centerline, Mich.*—8 *page bulletin*—Operating advantages and maintenance features of line of dust and fume eliminators are covered. Sizes and dimensions for manual and conveyor cleanout designs are noted and illustrations of various models are included.

Circle 516 on Page 17

Photoelectric Developments

Autotron Inc., Box 722-RR, Danville, Ill.—8 *page bulletin*—Plug-in mounted photoelectric controls and light sources; miniature phototube and light source heads; impact actuated electronic controls, and timing controls are a few of the items described. Installation diagrams and prices are also given.

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Automatic Welding Supplies

Lincoln Electric Co., 22801 *St. Clair Ave., Cleveland, Ohio*—8 *page bulletin*—Data on electrodes and fluxes for automatic submerged arc welding and hardsurfacing is given in Bulletin SB-1354. Applications of the various components are noted. Typical properties of weld deposits, and a guide for flux selection are also included.

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Flexible Link Shaft

Clark Flexible Link Shaft Co., P. O. Box 73, *Newton Highlands* 61, *Mass.* —6 *page bulletin*—Flexible shaft with equal torque in both directions that is used for remote controls and power drives is described. Applications and specifications are listed, and torque rating and motor speeds given.

Circle 519 on Page 17

Automatic Lathes

Bullard Co., 286 *Canfield Ave., Bridgeport* 9, *Conn.*—16 *page booklet* —Hydra-Feed tracer lathes for turning straight, tapered or contoured work are described. Special tooling accessories for rough turning, finish turning, and contour turning operations are also covered. Special units and attachments are illustrated.

Circle 520 on Page 17

Data Processing Systems

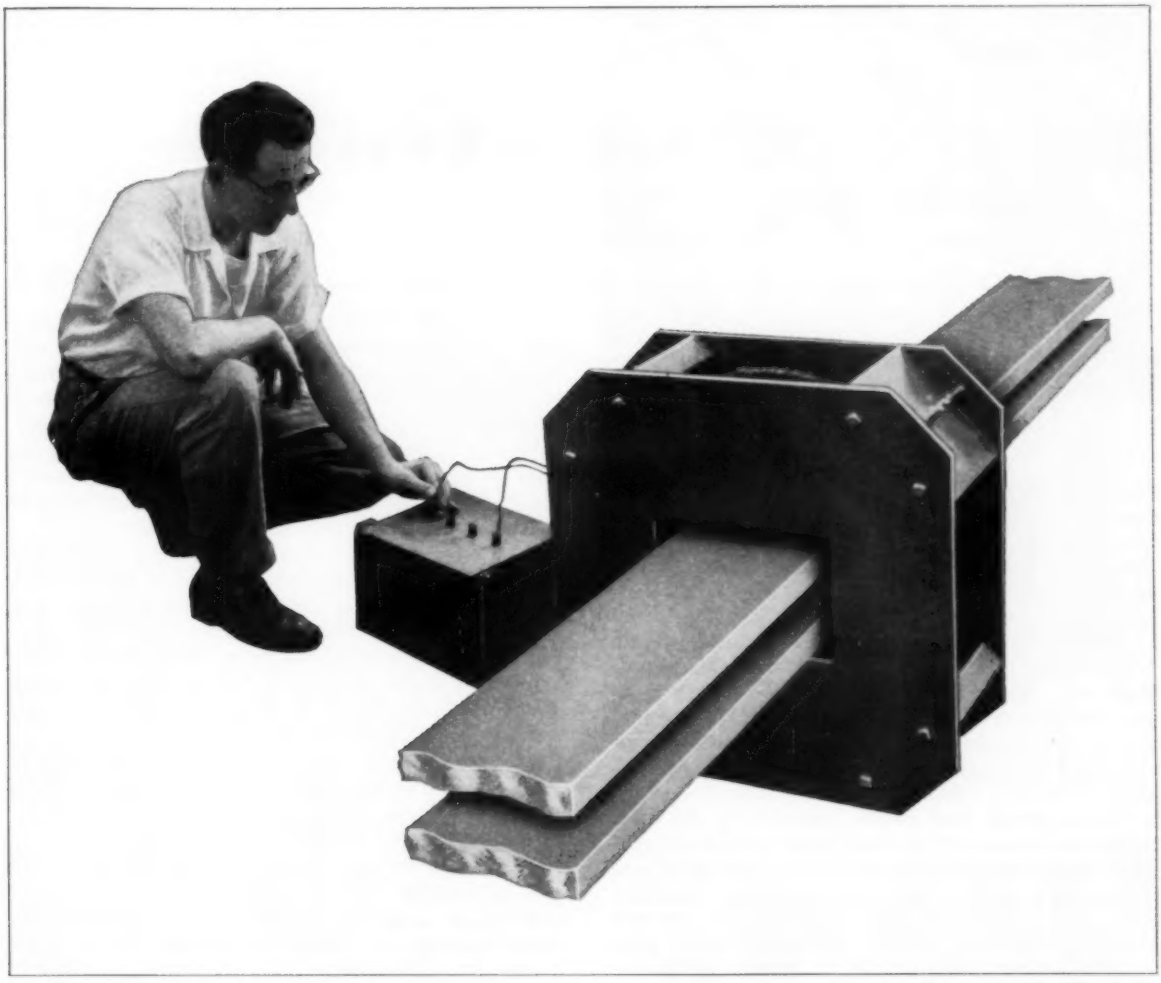
John Diebold & Associates Inc., 40 *Wall St., New York, N. Y.*— 14 *page booklet*—Step-by-step approach to data processing, from problem definition to programming aid, is described. Company's service is outlined and illustrated.

Circle 521 on Page 17

Machine Tool Controls

True-Trace Sales Corp., 9830 *E. Rush St., El Monte* 41, *Calif.*—24 *page handbook*—Intermittent positioning systems, hydraulic tracers, numerical controls and programming consoles are described and illustrated. Accessories such as hydraulic cylinders, power units, hydraulic milling spindles, coolers, and mounting brackets are also covered.

Circle 522 on Page 17



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AUTOMATION abstracts

NATIONAL IMPLICATIONS OF AUTOMATION

By REPRESENTATIVE WRIGHT PATMAN (TEXAS)
Chairman, Joint Economic Committee of the Congress
Chairman, Small Business Committee of the House of Representatives

FROM EXPERIENCE as chairman of a Congressional committee which has twice held hearings on the subject, I know that a favorite question among laymen when faced with some one who dares speak of automation is to demand forthwith a precise, explicit definition of the word. Well, I am not even going to try to satisfy that longing and define "automation."

I prefer to think of "automation" as a broad umbrella word. For this purpose it covers not only feedback controls, servomechanisms, and printed circuits, but the whole mass of devices, procedures, and know-how which go to make up the rush of postwar technological change. Certainly the label is not important to the employee who suddenly finds his skills no longer needed and his job gone. Nor does a management which sees in a new electronic gadget an opportunity to cut costs or get production data computed more quickly, recognize that its actions are part and parcel of the trend toward automation which gets written up every now and then in Sunday newspaper supplements with a mixture of wonderment and suspicion.

The Broad View

From the standpoint of the Nation, the important thing is not so much the devices themselves, but what they mean to economic stability and what they may contribute to continued rising levels of living. As a nation, our concern is not simply what these automatic devices and technology mean to the individual firm or productive process—we are interested in what their impact may be in terms of benefits to our way of living and what problems they may create by way of forcing broad economic adjustments.

As one concerned with broad public policy, I view my task as one of pointing out some of the ways in which the economy as a whole, or our society as a whole, is concerned with advancing technology. In the process of pointing these things out I hope to remind you that private business decisions often have broad implications to the successful operation of our economy.

Rapid advances in industrial processes and the continual installation of labor-saving devices are not new to us here in the United States; they have characterized our industry for decades. The result of this advancing technology has been rising productivity for both workers and machines. Over the past half century, output per man-hour-worked in the manufacturing plants of our country has increased by an average of about 3 per cent per year. In the decade since the end of World War II, it has been stepped up somewhat above that long-run trend.

One result of this industrial and worker efficiency has been to give us not only the world's highest level of living, but a level which we could scarcely have dreamed of a few decades ago. We have even managed as a nation to double, in the past ten years, the number of weeks spent on vacations, while increasing gross national product in terms of real goods and services by some 42 per cent.

Clearly one of our first concerns as a nation is to preserve the setting and cultivate the forces which have made these things possible. It is appropriate, therefore, to ask ourselves what factors appear to have been most responsible in contributing toward this remarkable rate of progress.

When we undertake to define these conditions, we have to place quite high on the list two or three things which in a sense are not primarily economic nor political at all. Perhaps even more important from the standpoint of public policy is the fact that they cannot be easily purchased in the common market place by either business or government. Nor are they easily assured by even the wisest private or public management.

Above all purely economic conditions, we must, in short, give major credit for our high standard of living and rapid technological progress to the persistence and strength of the characteristic American enterprise spirit. We are not a people in this country who shrink from challenges. We are, as a rule, unwilling to rest on our oars. We are inclined to welcome changes. We meet the problems involved in production and the application of our economic resources with a confidence that better ways of living are to be had by all, if we but put our minds to it and strive for them. Happily, there appears to be no immediate threat to the continuance of this stimulus. It is important, nevertheless, that we at least recognize this national heritage and be constantly alert lest anything tend to weaken or undermine this spirit.

Closely related to this trait is the extent to which national growth in the past has been dependent upon the stimulus of innovation and invention. The prosperity which we have enjoyed over the years, partic-

ularly since the second World War, has been in a large measure the result of a steady flow of investment opportunities which have come from translating new ideas and new inventions into the realm of new jobs and new products. In order to keep this stimulus rolling up new cumulative effects, we must depend in part upon widespread and adequate scientific training. This is a point at which we can, as a matter of public policy, do something.

Special Manpower Needs

Perhaps the most disturbing thing which came to the attention of the Subcommittee of which I was chairman inquiring into the problems of automation was the evidence given by experts indicating a growing shortage of scientists and engineers in this country. Our supply of technical and professional manpower, we are told, is not keeping pace with the demands for scientific personnel. Even more disturbing —there seems also to be reason to believe that Russia and some of the other countries are catching up and threatening to surpass us not only in numbers, but possibly in quality of technical and scientific skills. On February 14, 1957, Dr. Edward Teller, renowned American physicist, who was intimately associated with the developments of the hydrogen bomb, told a conference in Washington that "ten years from now the best scientists in the world will be found in Russia." He pointed particularly to the Soviet's devotion to technological training and their elevation of the position of scientists. No matter how much we may abhor their system of a planned economy with its loss of individual freedom, no matter how much we may question the statistics on comparative numbers graduating in engineering and technology each year, we as a nation can hardly afford to be complacent at seeing our superiority in the field fading.

We must not overlook the fact that the great pool of knowledge created in this country by the war and the war educational programs is not inexhaustible. As Dr. Vannevar Bush pointed out to our Subcommittee, we came out of the war with the cumulative results of having kept scientific research under forced draft for a number of years. We had, moreover, millions of persons returned to civil life who had acquired familiarity and knowledge of technology which, under other circumstances, would have been reserved for a few specially trained specialists. This great pool is not self-replenishing. The risk of its depletion deserves the fullest attention of all of us in making sure that training is made possible for all young people who have demonstrated ability and aptitude.

This advancing technology which has found its roots in the things we have been discussing—American attitudes, the surge of innovation upon innovation, and the widespread diffusion of scientific knowledge—has gone forward under the traditional American free enterprise, free market system. The frontiers of science were of course pushed back under the impetus of government expenditures and wartime needs, but the process of turning this knowledge into a flow of new and better products has been a major postwar accomplishment of private enterprise.

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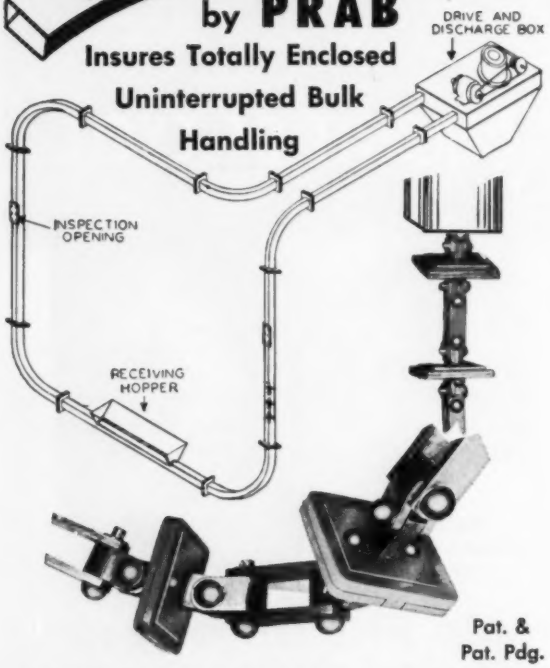

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Role of Government

Since, under our economic system, we depend upon dynamic free business to produce the goods which people want, the question naturally comes to the minds of some as to just what business government has anyhow in probing around in connection with this so-called automation movement.

First of all, government—good government—really exists for the benefit of the people who live under it. If the introduction of new automatic production methods means fewer and fewer jobs—if it means more and more unemployment with resultant personal hardships for large numbers of individuals—it would clearly become the concern of government, because the business of government is the welfare of the people. The prosperity of our society depends upon the constant shifting and reallocation of resources. But when the resources to be shifted are human beings, it is incumbent on government to make sure that the social good is not singling out individual workers to bear a disproportional share of the costs. Government, moreover, has a responsibility in helping to develop and maintain a climate conducive to economic growth and full employment.

In order to see just where the trend toward automation and rapid technological change might be carrying us, our Subcommittee held extensive hearings in the fall of 1955. We took a quick look at developments again a year later. At those hearings, representative businessmen and spokesmen for the labor unions appeared, discussing the problem as it affected them. The purpose was to bring out the facts in order that the public, the Congress, and the interested parties themselves might better understand what the possible long-run effects of rapid technological advancement might be.

The fact that such an inquiry was made, or that the Congress continues to be interested in automation and will doubtless hold more or less periodic hearings on the subject, must not be misunderstood. It must not be interpreted as evidence that government or the people in Washington are trying to extend governmental control into industrial fields or other manufacturing processes.

The Government's interest in automation is primarily that of making certain that the individual, human costs of widespread material progress are kept at a minimum. We want to be sure at all times that the private enterprise system upon which we rely is functioning smoothly today and is not building up pressures or frictions that may mean trouble in the future.

Specifically, the Joint Economic Committee of the Congress was, and continues to be, concerned with how public policy should be adjusted, if need be, to deal with such things as: (1) the effect of automation on over-all employment levels; (2) the extent of possible and probable displacement of workers; (3) the impact of automation upon our business structure —upon small and large businesses; (4) the effect of automation upon the volume and regularity of private investment; and (5) the possible shifts and distortions which may arise in the distribution of mass purchasing power. There are a number of other

questions which come to mind—for example, the equitable distribution of the expected gains in productivity. I won't undertake to go into all of these.

Automation and Employment

Let us first look at the question of jobs and the possible threat to the maintenance of high employment levels. The greatest obstacle to realization of the fruits of automation lies in the possibility that the economy may fail to find other useful work within a reasonable time for those who may be displaced by the installation of new machinery or new techniques. The whole process of improved productivity and the lessened need for sweat-of-the-brow, at any point in the economy, are desirable ends in themselves. But they would certainly be self-defeating and empty if equivalent human resources are wasted elsewhere. The process of turning repetitious and uninteresting clerical tasks over to a computer gets us nowhere if the clerical mind is left to even less challenging boredom.

The loss of jobs and the displacement of personnel may present serious personal and community problems in the short run. We must face up to that probability even though one may have confidence that technological advances will, in the end, create new job opportunities. By reducing costs, technology may be expected to bring with it an increased demand for goods and services which in turn makes for added investment and expanded payrolls.

The special problem, if problem there really is, growing out of the current wave of automation is the possibility that it will overwhelm us in a comparatively brief time. We have in the past generally been able to take increased mechanization in stride. But we must remember that much of the technological change to which we have adjusted so comfortably in the past came upon us gradually. Modern automation, on the other hand, could come so fast as to swamp us. I don't think it will, but we would do well to recognize that possibility so that we can be prepared to cope with it if need be.

Responsibility of Industry

If a worker's job or the need for his skills is affected by the installation of automatic processes, the primary responsibility for helping to ease his adjustment rests, I am convinced, upon the employing industry or the business itself. We can hardly regard as sound, genuine progress an industrial change of any kind that cannot pay its own way. Efficiency and productivity, to be worthy of their name, must result in sufficient savings or increase in product to take adequate care of all costs, including personal hardships, which the introduction of new machinery brings about.

The problem has some similarities to that of covering the costs of industrial accidents. It was common a few generations ago to let the burden of medical costs and loss of potential earning capacity resulting

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from industrial accidents fall upon the unlucky worker who happened to stand in the way of the accident. It is now more or less universally recognized that the people who use the products produced by those industries in which physical hazards to workers are especially high must expect to carry an added burden by way of insurance in the form of a higher price for the product. Costs of re-training and relocating workers displaced by machinery ought to receive somewhat similar treatment.

Happily, American industry and American business management have, in general, shown an appropriate feeling of responsibility for re-training or, if necessary, finding other suitable jobs for those workers whose jobs are taken over by new machines. In nearly every case which came to the attention of our Congressional committee, enlightened business management was apparently well aware of and doing what it could to meet these costs. I am sorry to say, however, that one or two cases did come to our attention where individual companies were apparently not doing all that could be done to lessen the personal hardships of job losses or job changes resulting from increased mechanization. In the interest of our continuing as a nation to reap the great benefits of technological change, I hope this type of exception will not bring the whole principle of automation into disfavor or disrepute.

Federal Safeguards

Over and beyond this responsibility on the part of private business itself is the willingness and determination of government, as the representative of all the people, to see that everything possible is done, under the free enterprise system, to avoid large-scale unemployment if free industry falls down on the job. To the extent that we as a nation have been and are able to maintain a generally prosperous economic situation across the board, the individual and personal hardships caused here and there by the installation of new automatic machinery will be less painful and troublesome. The worker who loses a job for whatever reason—including the introduction of labor-saving machinery—has less to fear if he lives in a country where he can readily find another job of his own choosing under similar or better working conditions.

Under the Employment Act of 1946, the Government of the United States has undertaken to use all of its own plans and resources to create precisely those conditions which will make for maximum employment opportunities. The declared policy of Government is to promote conditions which will afford job openings for all those who are desirous and capable of working. This, mind you, is to be sought not by Federal Government means alone, but with the assistance and full cooperation of industry, labor, and State and local governments. In the words of the Act it is, moreover, to be done "in a manner calculated to foster and promote free competitive enterprise."

While one might hesitate to expect the Government to bring its fiscal powers of taxation and spending to bear directly upon solving any problems arising from automation, the Federal Government can make

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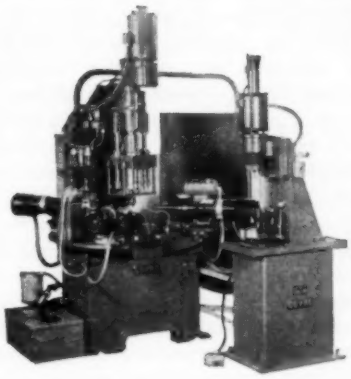

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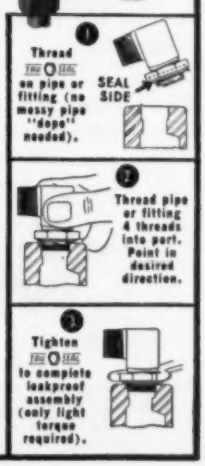
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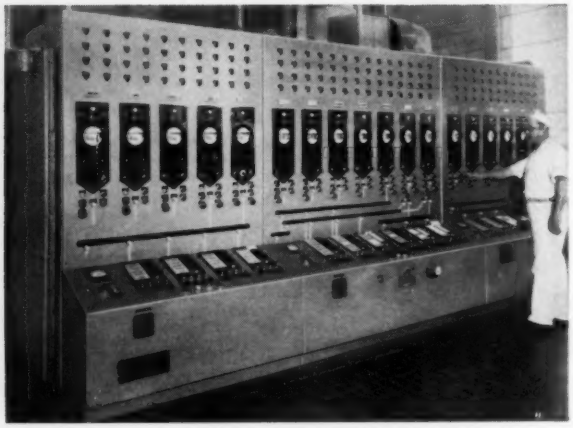

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a great contribution toward stabilizing industry and employment and promoting economic growth. While avoiding the necessity of interfering specifically with the conduct or behavior of particular individual citizens or enterprises, the Government's policies can make substantial contributions in creating the climate in which there are plenty of jobs. Fiscal, monetary, and regulatory policies can all help toward a smoothly operating, dynamic economy; and that is certainly our best assurance from the fears of automation.

We have, of course, built into our economic and political system, Federal and State programs for unemployment benefits. By providing weekly payments to those who are suddenly or temporarily thrown out of work for reasons outside their personal control, these insurance and compensation systems do provide a partial cushion. Important as unemployment payments are to the individual worker who is unfortunate enough to lose his job, such payments are no more than temporary aids helping him to bridge the gap. If automation does throw workers out of jobs, the real solution to the personal problem must look toward providing the worker with re-training or reassignment. Through the cooperative efforts of the worker, his union, his industry, and the Government, the individual worker's skills can be salvaged or new skills acquired.

The hardships of the displaced older worker are, of course, not limited to those who might lose out as a result of increased automation. Our general programs for old age and survivors' insurance, while designed for the broader problem, nevertheless make some contribution also in individual cases arising out of the installation of new, fast, automatic machines. The middle-aged worker who may find his skills, which he has spent a lifetime in acquiring, rendered obsolete overnight, has every right to expect his employer, his union, and society at large—that is, the Government, if need be—to recognize his plight. They must all assist in his re-training or, if it has to be that way, his relocation to some other place where jobs are.

A Place for Small Business

Let us now turn to another aspect of the trend toward new automatic machinery which is of considerable public concern. I refer to the probable effects of automation upon the relative position of large and small business. There can be little doubt but that large, established businesses with large mass markets will find great advantages in improving automatic processes. As a matter of fact, the gains of automation are often dependent upon a company being able to make a relatively large initial investment.

On the other hand, there is considerable hopeful testimony to the effect that smaller, less expensive models of automated machines and computers will become available in due course. Small business should, moreover, try to turn its disadvantages in this respect into an element of strength. Small business should be comparatively adaptable and flexible as compared to the cumbersome industrial giant. There will, let us hope, always be a place for the properly financed, well-managed little business in going after the trade

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Swanson Standard Indexing Chassis make it easier for you to automate a wide variety of manufacturing, processing and assembly operations. No longer do you have to design and build your special machines "from the ground up". When you start with a Swanson chassis, you get your automatic equipment started sooner . . . completed earlier . . . at lower cost. Swanson units have a place in your equipment specifications. Talk with your machine designers.

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OVER 200 STANDARD MODELS OF INDEXING MACHINE CHASSIS

Series B & C Turret Index Models—for medium and light applications.

Series H Turret Index Models—for heavy duty applications.

Series L Auto Tran Straight Line Indexing Chassis—for automatic or semi-automatic assembly and processing operations.

Series K Turret Index Models—for heavy duty applications with center column tool mounting.

ENGINEERS AND BUILDERS OF SPECIAL AUTOMATIC MACHINES

Circle 738 on Page 17

STAMPINGS

Produced economically in our modern plant for:

AUTOMOTIVE, INDUSTRIAL EQUIPMENT, DOMESTIC APPLIANCE, AGRICULTURAL INDUSTRIES AND OTHERS; will boost your output at material savings.

Our production, engineering and toolroom facilities are geared to the volume usage of *your* industry.

Send us your inquiries

LANSING STAMPING COMPANY

1157 So. Pennsylvania
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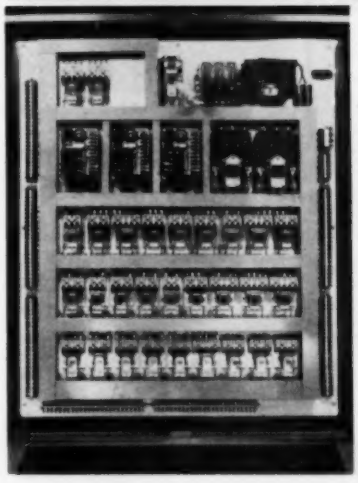
Established 1914

Circle 739 on Page 17

FAST DELIVERY!

FOR SAVINGS AT THE HEART OF AUTOMATION!



K-R Automation delivers control panels *fast*, on time. Whether we build from your blueprints or design from the ground up, you get exceptional savings and unusually high standards of workmanship. Send prints or contact us today for a prompt quotation. K-R Automation Corp. 19611 JOHN R, DETROIT 3, MICH. TWINBROOK 2-7040.

57-11

K R K-R AUTOMATION CORP.

Circle 740 on Page 17

TWO *pressure switches for the price of* ONE

At two predetermined set points in the same pressure system, Model 424 actuates two independent electrical circuits. One may be AC and the other DC if necessary.

MELETRON

MODEL 424

Typical applications are: in instrument air control as high-low warning, or as a lubrication system warning and safety shut down. If oil pressure drops below normal, a warning circuit is actuated and if pressure drops below the safe point, the machine is shut down.

WE BUILD IN	WE DON'T USE
EXTREME ACCURACY and DEPENDABILITY maintained during operating life due to direct acting design	**LINKAGES & BEARINGS** which as they wear, make the setting of the pressure switch drift.
OPERATION IN ANY POSITION which saves the installation costs encountered in mounting a switch that uses liquid switching elements.	**LIQUID SWITCHING ELEMENTS** which make the switch difficult to mount and very critical to vibration.
IMMUNITY TO VIBRATION you can mount the switch directly on your vibrating or moving equipment.	**ACCORDION DIAPHRAGMS** which make the pressure switch sensitive to vibration.

To get complete operating data and specifications ask for bulletins 424 and 425.

BARKSDALE VALVES

PRESSURE SWITCH DIVISION

5125 Alcoa Avenue, Los Angeles 58, California

of those who want specialized services or something besides standardized mass-produced items.

In any case, the Government has an important role in seeing that independent, small businesses have real opportunities to survive and grow. The dynamic free enterprise economy which we prize depends upon the continual initiative of our people in starting new businesses with a chance of developing into strong, healthy, competitive enterprises.

The Federal Government has already demonstrated its concern for small business through the creation of special select committees in both Houses of Congress. While all laws and administration of laws are always open to improvement, we can take pride in this country in the passage years ago of what we call our "anti-trust" laws. The intention of these laws is to keep big business within bounds, thereby giving small, new, and competitive businesses a climate in which they can grow without being smothered. Whatever the problems of small business may be, they deserve serious attention. Certainly small business has its share of difficulties, but fortunately it is not clear that automation as such is going to create new or overwhelming survival problems beyond those which already exist.

Other Considerations

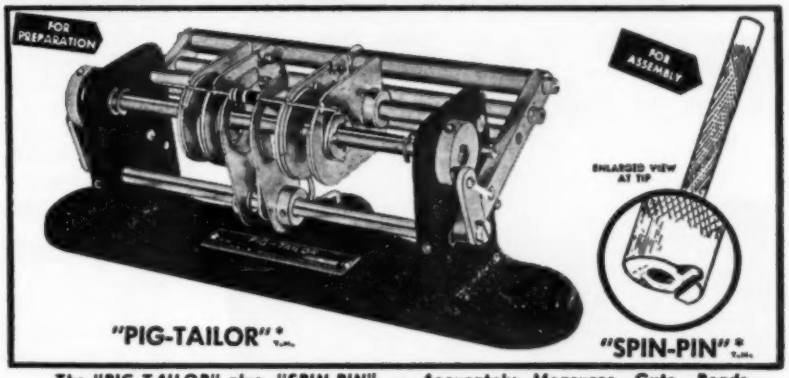
There are various other problems which automation poses for economic stabilization. They must be treated more briefly here than have those of possible unemployment effects and the challenge presented to small business.

One policy question, for example, involves changes in the distribution of purchasing power which may come about from the substitution of automatic devices for human labor. We know that consumers have urgent and expanding needs. We know, too, that these needs are translated into effective demand for products and services only when consumer purchasing power keeps pace with production. Industry, by its wage, price, and dividend policies can contribute toward a distribution of purchasing power which will best sustain the mass markets. Government likewise, by its fiscal policy and other means, can make some contribution. It is important that both industry and Government do what they can, for mass purchasing power is indispensable to mass production.

It seems likely that automation may find its fullest use in the big industries where so-called "administered prices" frequently prevail. Industry itself must take up the challenge in this respect. At the same costs, an enlarged volume of production will presumably be made possible by the turn to more automatic machinery. Unless the savings in the costs of production are passed through to customers by way of reduced prices or improved quality, we may find unsold goods piling up on the shelves because of a deficiency in aggregate purchasing power. If we allow our automatic machinery to click along while unsold goods pile up at the end of the assembly line because they are priced too high for the mass market, Government will doubtless be called upon to help bail out the situation. We all hope, I am sure, that this situation will not arise; but if it does, it will

"PIG-TAILORING"

. . . . a revolutionary new mechanical process for higher production at lower costs. Fastest PREPARATION and ASSEMBLY of Resistors, Capacitors, Diodes and all other axial lead components for TERMINAL BOARDS, PRINTED CIRCUITS and MINIATURIZED ASSEMBLIES.



The "PIG-TAILOR" plus "SPIN-PIN" — Accurately Measures, Cuts, Bends, Ejects and Assembles both leads simultaneously to individual lengths and shapes — 3 minute set-up — No accessories — Foot operated — 1 hour training time.

PIG-TAILORING provides:

1. Uniform component position.
2. Uniform marking exposure.
3. Miniaturization spacing control.
4. "S" leads for terminals.
5. "U" leads for printed circuits.
6. Individual cut and bend lengths.
7. Better time/rate analysis.
8. Closer cost control.
9. Invaluable labor saving.
10. Immediate cost recovery.

PIG-TAILORING eliminates:

1. Diagonal cutters.
2. Long-nose pliers.
3. Operator judgment.
4. 90% operator training time.
5. Broken components.
6. Broken leads.
7. Short circuits from clippings.
8. 65% chassis handling.
9. Excessive lead tautness.
10. Haphazard assembly methods.

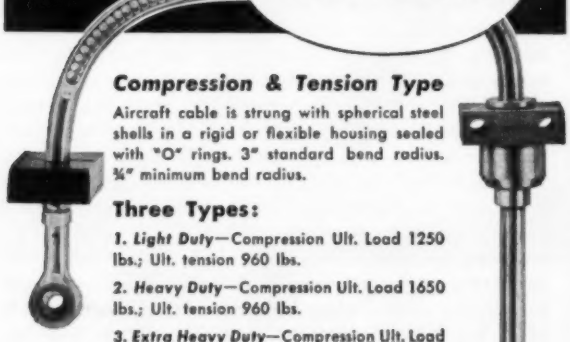
* PATENT PENDING

Write for illustrated, descriptive text on "PIG-TAILORING" to Dept. A-11P

BRUNO-NEW YORK INDUSTRIES CORPORATION
DESIGNERS AND MANUFACTURERS OF ELECTRONIC EQUIPMENT
460 WEST 34th STREET • NEW YORK 1, N. Y.

Circle 742 on Page 17

push-pull CONTROLS



Compression & Tension Type

Aircraft cable is strung with spherical steel shells in a rigid or flexible housing sealed with "O" rings. 3" standard bend radius. ¾" minimum bend radius.

Three Types:

1. *Light Duty*—Compression Ult. Load 1250 lbs.; Ult. tension 960 lbs.
2. *Heavy Duty*—Compression Ult. Load 1650 lbs.; Ult. tension 960 lbs.
3. *Extra Heavy Duty*—Compression Ult. Load 3050 lbs.; Ult. tension 3900 lbs.

Positive remote controls for actuating mechanical, hydraulic or other devices. Eliminate bell cranks, pulleys and dual cables. Patented U. S. A. All world rights reserved. Send for ENGINEERING MANUAL giving detailed prints and complete specifications covering materials, finishes, capacities. Please address Dept. A-57

SOUTHWEST PRODUCTS CO.
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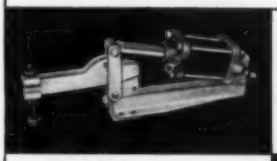
You asked for it . . .

KNU-VISE has come up with it!



TWO NEW AIR-OPERATED CLAMPS with 800 pound clamping force

AO-800 CLAMP

AODT-800
DOUBLE TOGGLE CLAMP

Because you asked for it, Lapeer's vast line of Knu-Vise clamps now features four distinct groups of air-operated clamps. Two new 800 lb. air clamps have been added to the widely accepted 200, 400 and 1200 lb. air clamps, thereby rounding out the Knu-Vise series. The Model AO-800 clamp is for conventional holding operations—the Model AODT-800 for those difficult mounting situations.

For complete information on these units and the more than 150 other models available, write for catalog today!

Manufacturers of over 150 models of manually and air-operated clamps and pliers

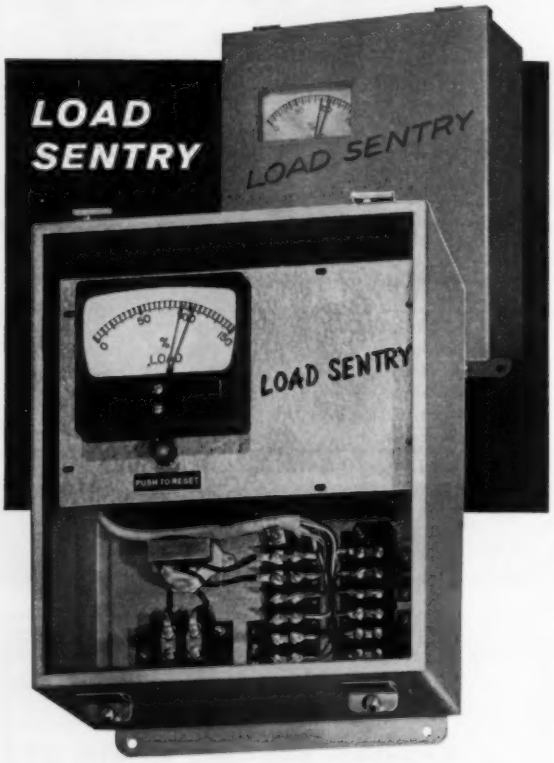
KNU-VISE PRODUCTS **LAPEER MANUFACTURING CO.**

3045 DAVISON ROAD • LAPEER, MICHIGAN

WESTERN DIV.: 419 Magnolia, Glendale Calif.
CANADIAN DIV.: Higginson Equipment Sales, LTD., Burlington, Ontario

Circle 744 on Page 17

NEED OVERLOAD PROTECTION?



Load Sentry, NEMA 12 Housing, price $225.00

With one pointer, you set the load limit anywhere on the dial. Another pointer shows running load on the motor. If an overload occurs, these pointers meet and a protective circuit is energized, or feed rate is changed, or the motor is shut down, as preferred.

EASY TO INSTALL: Eight easy connections to make—any plant engineer, electrician or maintenance man can do it.

ACCURATE: Meter-relay "heart" is able to detect two pieces of stock moving through a progressive die; 2% load increase will trigger protective circuit.

SAFE: After overload, an interlock prevents start-up until overload is cleared and reset button is pressed.

FAST: Shutdown or alarm is virtually immediate if overload occurs.

UNAFFECTED BY STARTING SURGE: No false shutdown while motor is drawing heavy starting current.

TO ORDER: Specify motor full load current; or horsepower, voltage, and phase.

Ask for Data Sheet 7-A

ASSEMBLY PRODUCTS, INC.
75 Wilson Mills Road • Chesterland 27, Ohio
Telephone: (Cleveland, Ohio) HAmilton 3-4436 and 3-4446

be in large part because private enterprise in the aggregate failed to supply the means to take the goods off the market at the prices asked. As Mr. Walter Reuther pointed out, automated machines, for all their productive efficiency, do not buy or consume their own products. While Government has some traditional antirecession tools in the form of monetary and fiscal devices, public works expenditures and the like, it depends upon the behavior of the private economy whether we have to rely upon them.

The Reduced Workweek

Another way in which the gains of increased automation can be absorbed would be by a reduced workweek. We all like to contemplate that possibility. We certainly ought not to think of the reduced workweek as an unfortunate device for spreading a reduced volume of work. Instead, it should be an opportunity to choose more leisure and make good use of it. Whether the leisure made possible by automation takes the form of fewer hours, longer weekends, or extended vacations, the prospect does present a challenge to public policy. The benefits ought to be spread, in due time, so that workers in industries not directly susceptible to time-saving automation will somehow share in the better life.

Another point about the connection between automation and leisure needs also to be made. If the time comes when the three-day weekend becomes a reality, we can be sure that some of the jobs lost through automation will be offset by substantial investment and new jobs in the industries serving our leisure time. Roads, motels, amusements, and the "do-it-yourself" industries will do much to soften the blow of decreased employment in the automated industries. To aid these developments, we must maintain mobility in our work force and flexibility in our thinking about industrial problems.

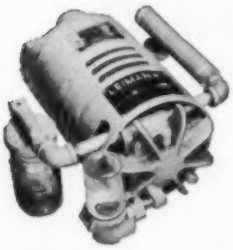
In conclusion, let me say that these are only a few of the problems which go to illustrate the need for Congressional and public awareness in order that the benefits of increased productivity and technology are not wiped out by unanticipated problems and social costs. We cannot expect greedily to grasp the benefits of new and cheaper products without giving some thought to the personal hardships which may have been involved in making them possible. Government has an important role in helping to cope with these problems. It alone cannot be responsible for avoiding personal hardships, but must expect cooperation of its citizens at every level. If the new technology comes upon us gradually, as seems probable, the adjustments need cause us little concern. If, on the other hand, new technology should overcome us so rapidly that industry and labor by themselves have difficulty in making the necessary adjustments, we do have in the Employment Act of 1946 machinery set up defining the Government's responsibility and establishing procedures for dealing with that responsibility.

From a talk entitled, "Automation in the National Eye" presented at the Second Conference on Manufacturing Automation co-sponsored by Purdue University and AUTOMATION *magazine, Oct.* 1957.

If your VACUUM or PRESSURE

requirements are in this range...

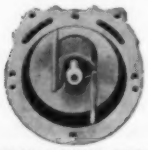
Vacuums to 27" Hg.
Pressures to 20 psig.
Displacement:
3.6 to 7.2 c.f.m.



...save space — simplify mounting—eliminate troubles —improve operation with

LEIMAN
INTEGRAL ROTARY AIR PUMP and MOTOR

MODEL K. 3.6 c.f.m. ⅓ hp. 13½" long—12" wide—7" high
MODEL K3. 7.2 c.f.m. ½ hp. 16" long—15" wide—9" high



AUTOMATIC WING ADJUSTER
Patented Leiman feature adjusts automatically, pushes steel wings into contact with cylinder wall, assures constant seal, prevents wings from sticking or binding.

FEATURES INCLUDE: Steel wings for long wear—automatic wing adjuster—ball bearings—automatic oiler—fan cooling—noiseless operation—automatic thermal overload protection for motor—inlet filter and outlet separatôr—oil-free air. Plus—famous Leiman dependability and lifetime performance.

Write for 12-page catalog giving details

LEIMAN BROS., Inc.
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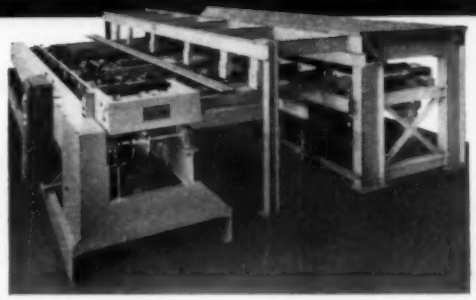
Circle 746 on Page 17

HOPPER FEED LONG ROUND BARS OR TUBES FROM HOPPER TO SHEAR AUTOMATICALLY



10,000 lb. bundles are dropped into hopper, shown at right. Metering transfer table, in center, transfers the bars to the "V" roll conveyor, shown at left, through metering hands and escapement fingers, which release one bar at a time upon receipt of a signal from the "V" roll conveyor, thus the powered "V" roll conveyor feeds the shears automatically and continuously at its maximum capacity.

"Automation Specialists—Since 1923"

SPURGEON CO.
23501 HOOVER ROAD
VAN DYKE, MICHIGAN

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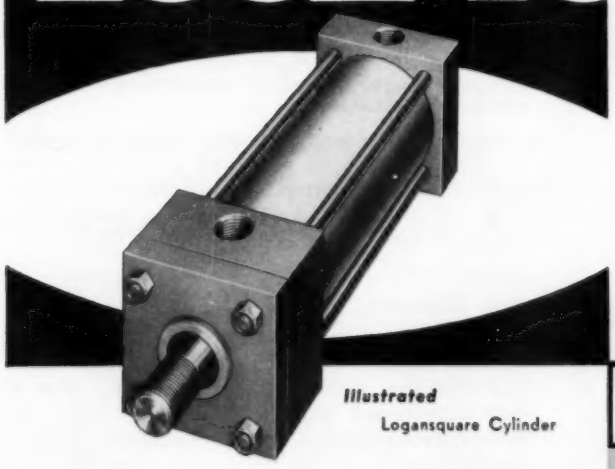
LOOK TO LOGAN



Illustrated
Logansquare Cylinder

LOGANSQUARE CYLINDERS ARE DESIGNED TO GIVE YOU PEAK PERFORMANCE IN EITHER AIR OR OIL SERVICE

MEMBER: *National Machine Tool Builders' Assn.; National Fluid Power Assn.*

Designed for low and medium pressures in either air or oil service, Logansquare cylinders meet a wide range of mounting applications and power movement needs. Regardless of your production requirements, Logan has the air or hydraulic components to serve you best.

SEND FOR FREE "LOGAN CALCULATOR"

LOGANSPORT MACHINE CO., INC.
848 CENTER AVE., LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:

- ☐ Facts of Life
- ☐ 100-1 Air Cyls.
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- ☐ 200-3 750 Series Hyd. Cyls.
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TO:
NAME _____ TITLE _____
COMPANY _____
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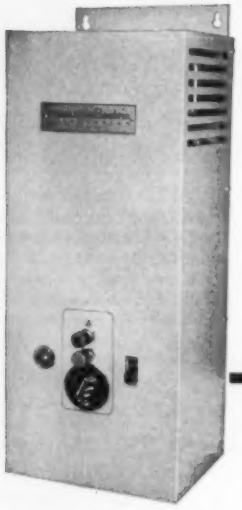
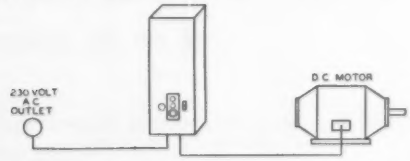
Get Full Range Stepless Speed Control With 100% Full Load Torque From 208/240 Volt AC Power Source

Press THE Button Set the Speed



Rev-o-trol, converts 230 volt alternating current to direct current and provides infinite speed range for standard shunt or compound wound direct current motors, maintaining 100% full load torque, if required.

Now, with Rev-o-trol, you can obtain *all* the advantages of full range speed control of direct current drive — even though alternating current is your only source of supply. Motor speeds can be reduced to as low as 3% of nameplate rating with 100% torque available at the lowest speed.



Any motor driven equipment, metal working, wood working, paper processing, packaging or conveying can gain advantages in productive capacity, elimination of waste, improve quality when Rev-o-trol speed control is properly used. Available in sizes up to and including ¾ H.P. Write for catalog R-313.

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1011 WATER ST. CUBA, NEW YORK

MANUFACTURERS OF

REV-O-TROL

AUTOMATION patents

Copies of patents are available at 25 cents each from the Commissioner of Patents, Washington 25, D.C.

CONTROL APPARATUS

Speed of a feed roll advancing a continuous web is adjusted with respect to speed of a second feed roll in accordance with the weight of web which is accumulated in a J-box between the rolls. Patent 2,797,086 by Joseph Cohn, Jules G. Walter and Eugene Cohn, assigned to Samcoe Holding Corp.

HYDRAULIC DRIVE FOR THE RECIPROCATING PARTS OF MACHINE TOOLS HAVING A WIDE SPEED RANGE STEPLESSLY CONTROLLED

Two pumps supply fluid to a reciprocating means. The spacing between the rotors and casings can be simultaneously changed to regulate quantity and direction of flow and one pump can be disconnected from the reciprocating means. Patent 2,799,138 by Ewald Dornhofer, assigned to Werkzeugmaschinenfabrik Adolph Waldrich Coburg, Coburg, Germany.

RESILIENT WHEEL APPARATUS AND METHOD FOR FORMING STRIP MATERIAL

Strip material is continuously formed by passing it between a shaped shoe and a resilient wheel which forces the material against the shoe. Patent 2,799,317 by Harry A. Toulmin Jr., assigned to Commonwealth Engineering Co. of Ohio.

CASE UNLOADER

Apparatus to unload bottles from cases has a head equipped with clamps operable to receive and discharge bottles onto a flat plate after a case is unloaded. Patent 2,799,414 by Elmer G. Streckfuss, assigned to Barry-Wehmiller Machinery Co.

MATERIAL HANDLING APPARATUS

Mobile track mounted carrier contains a storage reel and a liner belt reel. Plastic strip compound is wound onto storage reel between convolutions of the liner belt. When material is used, plastic feeds to machine and liner belt rewinds on reel in carrier. Patent 2,801,057 by Vincent A. Rayburn, assigned to Western Electric Co.

Circle 749 on Page 17

Ametron® ELECTRONIC CRANE SCALES

Weighs heavy loads suspended from crane hook. Printer, located in crane cab or other convenient location, records weight on tape or cards. New compact printer only 22" x 18" x 10½".

Entire assembly designed for prompt and easy installation. Now available at new low cost. Capacities 5, 10, 15 tons.

Write for Free Ametron Brochure 2

STREETER-AMET COMPANY
GRAYSLAKE, ILLINOIS

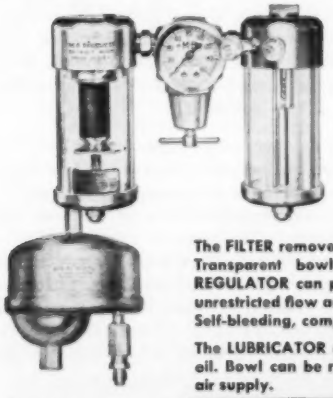
THE STANDARD OF ACCURACY SINCE 1888

Circle 750 on Page 17

GREATER PROTECTION to your AIR LINE!

M-B

WHIRL-A-WAY FILTER, REGULATOR AND LUBRICATOR ASSEMBLY AND AUTOMATIC AIR TRAP (MODEL W-4)



SUCCESSFULLY USED FOR PROTECTION OF AIR VALVES CYLINDERS CONTROLS PNEUMATIC TOOLS, ETC.

The FILTER removes solids .00039 and larger. Transparent bowl provides visibility. The REGULATOR can pass large volume with an unrestricted flow and minimum pressure drop. Self-bleeding, compact.

The LUBRICATOR delivers desired volume of oil. Bowl can be refilled without shutting off air supply.

The Air Trap is automatic and eliminates manual draining.

M-B PRODUCTS
46 VICTOR AVE., Div. 17
DETROIT 3, MICHIGAN

Circle 751 on Page 17

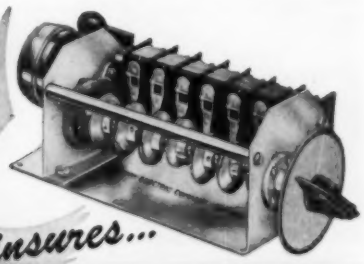
INCREASE PRODUCTION AND REDUCE LABOR COSTS *with* COOK & CHICK PART FEEDERS

We invite you to investigate our complete line of part feeders and escapements suitable for selecting and feeding parts automatically to machining and assembly operations. Tell us your job requirements and we will recommend the most suitable equipment.

COOK & CHICK CO. *Established 1879*
2415 W. 24th St. Chicago 8, Ill.

Circle 752 on Page 17

ZENITH Multi-Circuit CYCLE TIMER *insures...*



long-lasting accuracy . . . trouble-free performance in timing, mixing, compounding, processing and similar operations!

Sound, practical design, quality components and precision-controlled assembly insure the long-lasting dependability of ZENITH Multi-Circuit Timers. They are specified as standard components in countless commercial and industrial applications, as well as laboratory equipment and home appliances.

Can be supplied in practically any time cycle and with any number of switches. Available without synchronous motor for elevator control, limit switch, etc.

IMMEDIATE DELIVERY IN ANY QUANTITY . . . **Request bulletin.**

See classified telephone directory for name of local distributor

ZENITH ELECTRIC CO.
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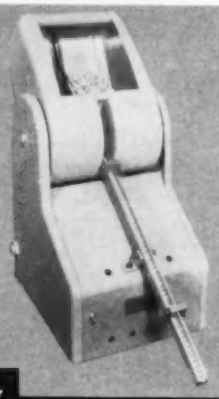
Circle 753 on Page 17

HOPPERAL

something NEW in small parts feeders

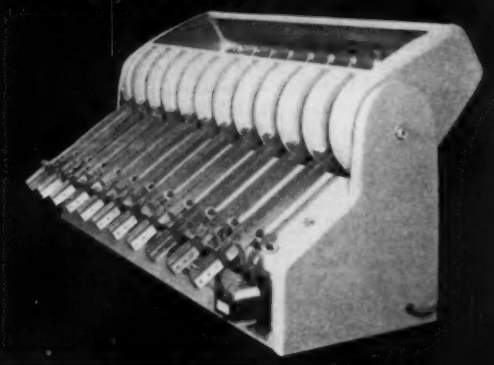
SINGLE TRACK

Orients and releases one or more parts in a single, smooth, sliding motion. Lifts part to track with a minimum of vibration or tumbling action. Fast, versatile, self-contained



MULTIPLE TRACK

Available with any number of tracks to feed parts to assemblies or other operations where a large quantity of parts is required simultaneously. Can be partitioned and supplied with properly designed tracks to feed unlike parts



HOPPERAL DRIVER

Can be equipped to drive small nails, drive screws, pins, rivets, roll pins and a multitude of similar parts. Will feed small parts for assembly requiring staking, press fitting, peening and riveting

Write for further information about these automated feeders and assembly machines.

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AUTOMATION

new books

FASTENERS HANDBOOK

By Julius Soled, consulting engineer; 430 *pages,* 6 *by* 9 *inches, illustrated, clothbound, published by Reinhold Publishing Corp., New York; available from* AUTOMATION; $12.50 *postpaid.*

Many currently available proprietary fasteners as well as some covered by standards are described in this book. The format includes an illustration, a description, and a listing of advantages, uses, available materials, sizes and manufacturers for most fastener types shown. Production equipment for stud welding, metal stitching, nail forming and driving, and explosive powder driving of studs and pins is also described. The last section of the book contains a directory of many U.S. and Canadian fastener manufacturers.

ELECTRONICS

By A. W. Keen, lecturer on electronics and telecommunications at Coventry Technical College; 256 *pages,* 5¼ *by* 8 *inches, illustrated, clothbound, published by Philosophical Library Inc., New York; available from* AUTOMATION; $7.50 *postpaid.*

The author, a British engineer of considerable experience in electronics, presents this account of electronic devices, applications and history in fairly elementary terms. Basic principles are outlined and components and circuits for modern equipment are explained. The aim of the book is to present an idea of the nature and scope of electronics to a reader with elementary knowledge of electricity and magnetism.

INTRODUCTION TO OPERATIONS RESEARCH

By C. West Churchman, Russell L. Ackoff and E. Leonard Arnoff, all from the department of engineering administration, Case Institute of Technology; 645 *pages,* 6 *by* 9 *inches, illustrated, clothbound, published by John Wiley & Sons Inc., New York; available from* AUTOMATION; $12.00 *postpaid.*

Based on lecture material for the Case Institute of Technology course in operations research, this book emphasizes the importance of a scientific approach to the solution of executive-type problems in business and industrial organizations. The steps of problem formulating, construction of mathematical models, solution of models, and evaluation, control and implementation of answers derived, are treated in detail. A discussion of administration of OR programs, and examples of optimization of decisions relating to inventory control, allocation of limited resources or efforts, waiting time, equipment replacement, and economics of competition, are included. Works of several other authors are used and extensive bibliographies are provided.

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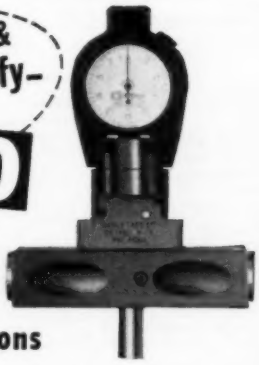

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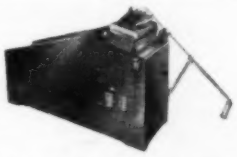
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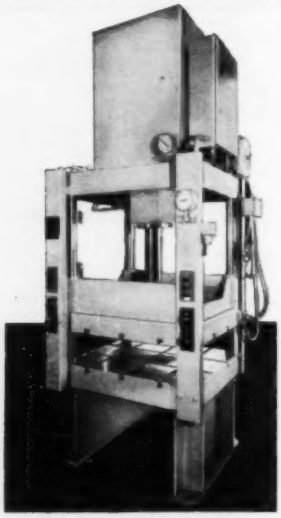

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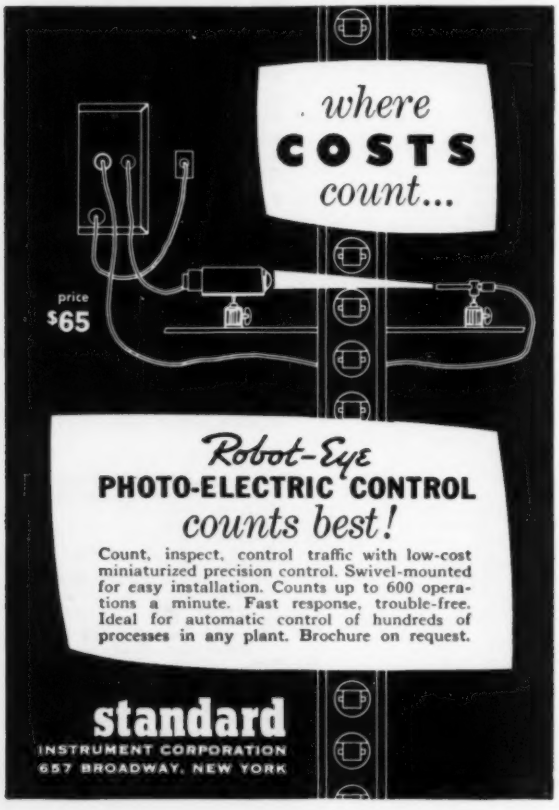
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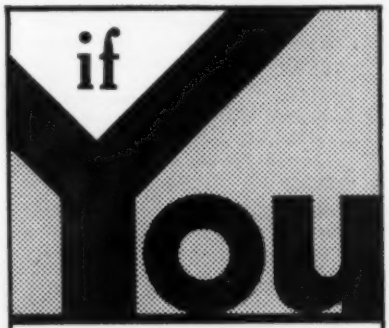

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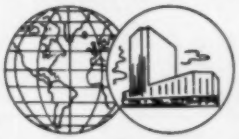

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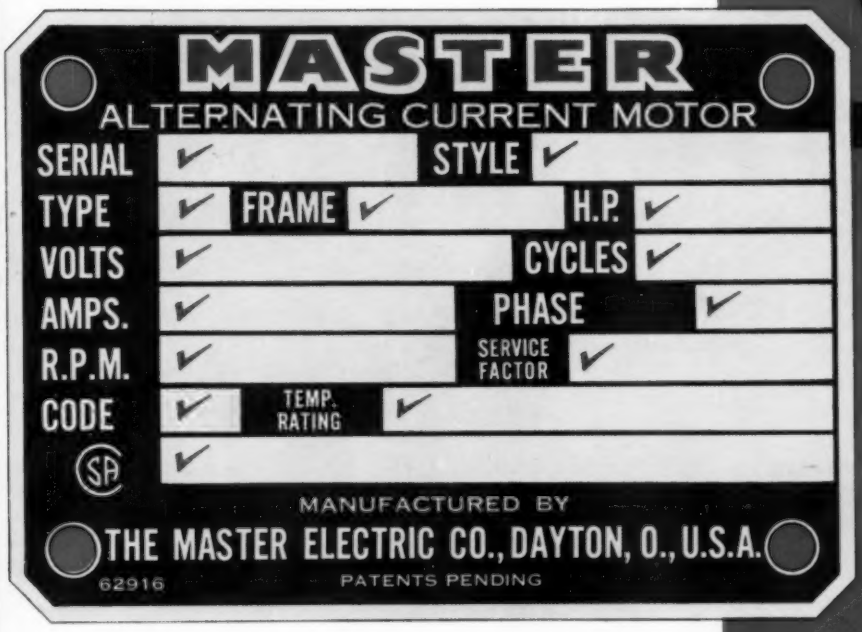

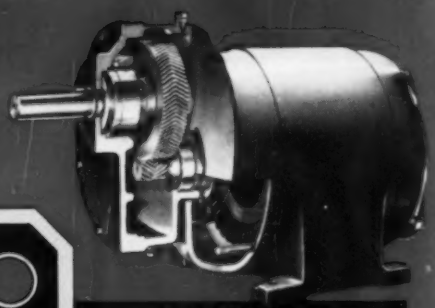
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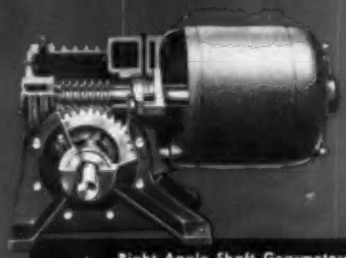
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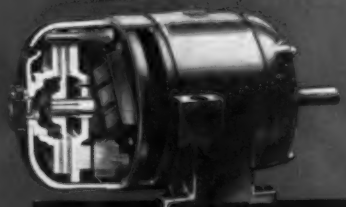
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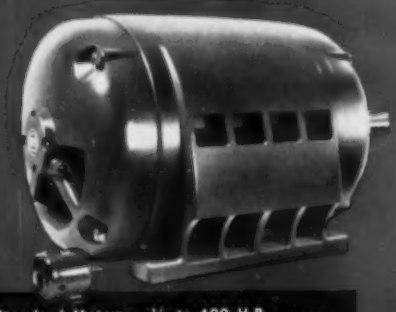
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